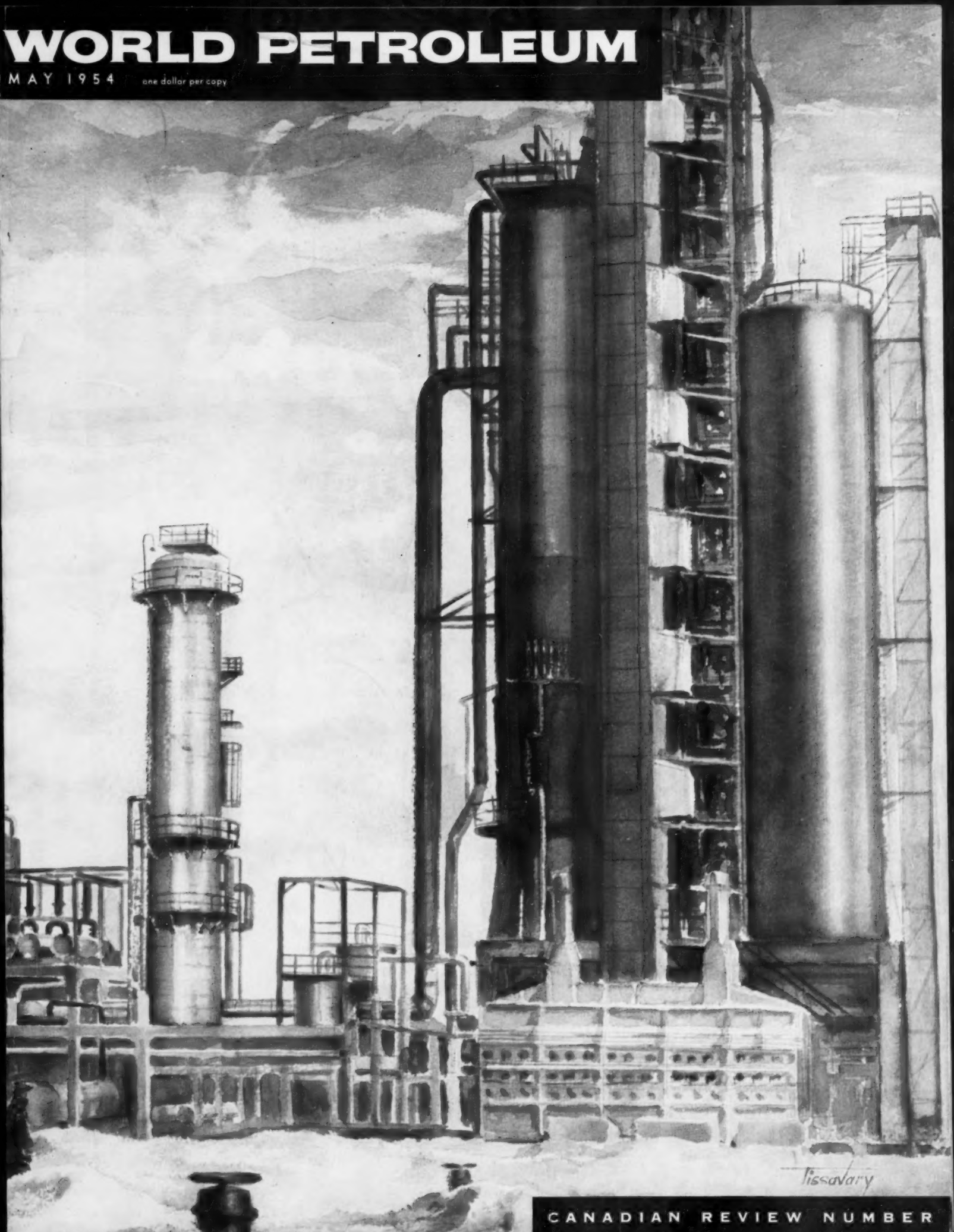
WORLD PETROLEUM

MAY 1954 one dollar per copy



CANADIAN REVIEW NUMBER

"RETAINED VOLATILITY" Seasons YOUR MOTOR FUEL

Make certain your Motor Fuel loses none of its high quality before or after it gets into the customer's tank.

Blending with NATURAL GASOLINE will "season" your product with RETAINED VOLATILITY.

You can depend on WARREN'S production, transportation, storage and SERVICE for the quality and quantity of NATURAL GASOLINE you need — when and where you want it.

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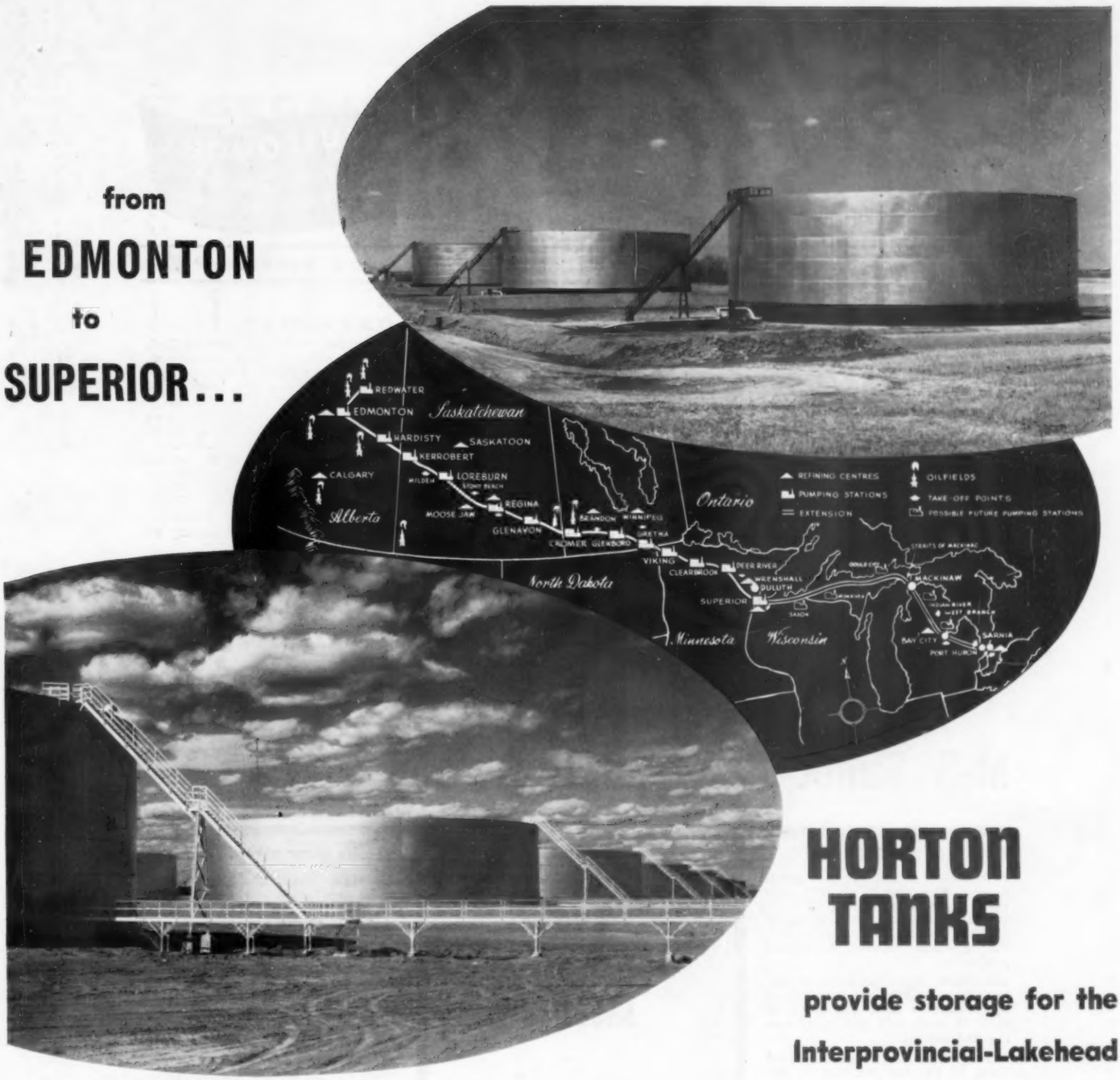
from

EDMONTON

to

SUPERIOR...



HORTON TANKS

provide storage for the Interprovincial-Lakehead

Along the 1770 mile Interprovincial-Lakehead Pipe Line, Horton® tanks were installed to provide maximum efficiency and economy in handling and storing the crude transported. This pipe line, the longest crude oil pipe line in the world, extends from Edmonton, Alberta, through Superior, Wisconsin to Sarnia, Ontario.

Completion of the Interprovincial-Lakehead Pipe Line provides transportation facilities for continuous year around movement of crude from the Alberta fields to Ontario refineries. Previous to completion of the pipe line, the closing of Lake Superior to navigation for about 4 months each year stopped the shipping of crude oil to Ontario.

Horton tanks for the Canadian installations were built by Horton Steel Works, Limited and the Superior, Wisconsin structures by Chicago Bridge & Iron Company. Chicago Bridge & Iron Company affiliates and licensees build welded steel plate structures for the petroleum industry in all parts of the world. When planning installations of any sort, be sure to write our nearest office for information, estimates or quotations.

Top View: Three 140,000-bbl. Horton cone-roof tanks at Edmonton, Alberta. Center: Map of Interprovincial-Lakehead Pipe Line. Lower View: Group of Horton cone-roof tanks at the Superior, Wisconsin station.

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W. P. Bryant, Edifico Abreu 402, Havana, Cuba
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What's NEW

In Perforating, Logging, and Fishing Tool Services

McCULLOUGH
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

2 hours and 35 minutes

PROBLEM: New Well. Operator wanted well bullet perforated fastest way.

SOLUTION: McCullough 4¼" M-3 Bullet Gun Perforator shot 334 ½" holes in 7" 23-lb. J-55 cemented casing between 4013' and 3940'. Eight runs were made to perforate 73 feet of zone. (26' at two holes per foot and 47' at six holes per foot.)

RESULT: Job was completed during a snow storm in two hours and 35 minutes. Good well. Production figures not given

NEW Perforators SOLVE Toughest Problems!

0 B/D to 120 B/D

PROBLEM: Well had been drilled, tested, plugged and abandoned. Another company, believing production was possible, bought old hole and set 5½", 17-lb. casing.

SOLUTION: McCullough Neutron Log located two thin potential zones. Both thin intervals were accurately perforated (48 shots total) in one run in the hole using McCullough Standard Casing Glass Jet Perforator and Steel Strip Carrier (10,032' to 10,038' and 10,042' to 10,048').

RESULT: Well came in flowing at 120 barrels per day.

McCULLOUGH

Perforating Service

M-3 Bullet Gun and Glass Jet *Perforators*

75 B/D to 250 B/D

PROBLEM: Well had been perforated through 7" casing by another company and was producing 75 B/D. 7" casing went bad and a string of 5" was run inside and cemented. The operator wanted to regain production.

SOLUTION: McCullough Super Casing Glass Jet Perforator and Steel Strip Carrier fired 176 shots at 9155' through both strings of casing and cement.

RESULT: Production was increased from 75 barrels per day to 250 barrels per day. Time on the job—two and one-half hours.

"World's Hardest Shooting"

Results after others failed

PROBLEM: Hard, shaley-sand had to be sandfraced to get production after perforating. Well had been perforated by another service company on three different occasions (four jet holes per foot). Formation would not break down under pump pressure up to 3000 lbs.

SOLUTION: McCullough Tool Company was called on the job. Twenty ½" bullets were fired, three holes per foot, by our M-3 Perforator.

RESULT: Formation broke down under 600 lbs. pump pressure. Time on the job—one hour. Resulting production—50 barrels per day.

For Best Results—Log AND Perforate—by McCullough

PERFORATING, RADIATION LOGGING, AND FISHING TOOL SERVICE—ANYWHERE—ANYTIME.

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P. O. Box 2575) • Houston, Texas
CABLE ADDRESS: MACTOOL
EXPORT OFFICE: Los Angeles, California
CANADA: Edmonton, Calgary, Grande Prairie, Alberta; Regina, Sask.
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: **TEXAS:** Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls, Luling, Beaumont, Sherman, Midkiff, El Campo. **OKLAHOMA:** Oklahoma City, Guymon, Healdton, Hominy, Wewoka. **ARKANSAS:** Magnolia. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper, Cody, Newcastle. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling. **NORTH DAKOTA:** Williston. **UTAH:** Vernal.

WORLD PETROLEUM for May, 1954. Vol. 25, No. 5 May, 1954. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 604 Fifth Ave., New York 20, N. Y. Acceptance at East Stroudsburg, Pa., under Section 34.64 P. L. & R. Authorized Subscription rate: $5.00 per year, single copies $1.00. Copyright 1954, by Mona Palmer, Trustee.

IT BEGAN WITH A RAFT

AND A BOLD ARMENIAN

ABOUT 500 years B.C., an Armenian merchant, looking for new markets, resolved to take a "capital risk".

He loaded a raft with stretched-hide containers of asphalt and bitumen, plus a half dozen asses, and floated hundreds of miles down the Euphrates to Babylon.

His venture paid off. He sold his wares at a profit, and he and his crew rode home on the backs of their animal passengers.

So was taken the first step in the water transportation of petroleum products.

Some 2,400 years after, the latest step is taken:

April 20, 1954, saw the launching of the first of four Cities Service super tankers to take their places as queens of the world's oil fleet. Their size and appointments should make even today's tanker men—much less our Armenian friend—gape with astonishment.

They will carry more oil in less travel time than any other tankers in service today. Air-conditioned, with individual staterooms for all, they'll have crew comforts and conveniences never before seen on tankers.

They will be, in short, the latest word in oil transportation. Not the "last word"—for there is no such thing. (The Armenian probably thought *he* had it!) Oil companies will continue to find better ways to move their products—so they can continue to lower the prices you pay for them.

The four new "luxury liners" of the Cities Service fleet are merely the latest chapter in a long, long story ...AND THE END IS NOT YET.

CITIES SERVICE

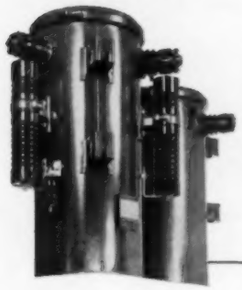
Quality 5-D Products

Oil makes him an independent businessman . . .

His office is on America's highway. His customers sit in the driver's seat. Of the 200,000 service stations in the U. S. about 95% are independently owned or operated. As independent business men, their job is to keep America's wheels moving. Texaco Dealers operate in all 48 states — maintain their position with the aid of outstanding petroleum products plus their own dealer know-how. Here indeed is a striking example of free enterprise at work in a highly competitive economy.

The Texas Company

One-Source Buying Means Integration & Lower Costs!

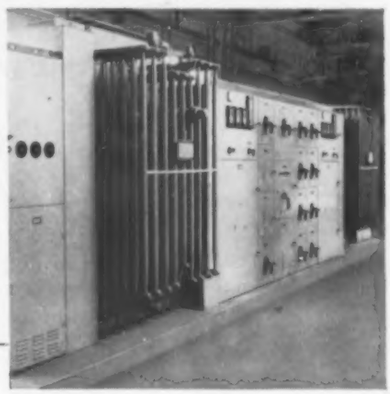


G-E SPIRAKORE TRANSFORMERS IMPROVED 2 WAYS!

New nitrile rubber gaskets at all tank openings prevent breathing . . . seal out contamination . . . resist oil, sunlight and atmosphere . . . are easily removed and used again and again.

New gapped pellet arrester: isolated from high-voltage lead . . . prevents line grounding in case of damage . . . has double discharge capacity . . . cannot corrode.

Also, G-E **Thyrite Lightning Arresters** have been improved for better station and line protection.



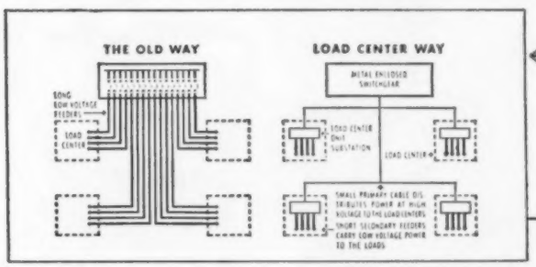
G-E Unit Substations Cut Power Costs!

Are your power needs increasing? Plan now to avoid shutdowns. Call in your G-E representative for the facts on compact, metal-enclosed G-E unit substations, indoor or outdoor.

They save you time: you select a standard unit directly from G-E specifications. Delivery is quick.

They save you money: voltage improves, copper is saved by eliminating long, secondary circuits; secondary selective system for duplicate power sources.

They give you safety: completely metal enclosed; modern, high-interrupting capacity breakers.


THE OLD WAY
LOAD CENTER WAY
METAL ENCLOSED SWITCHGEAR
LOAD CENTER UNIT SUBSTATION
LOAD CENTER
SMALL PRIMARY CABLE DISTRIBUTES POWER AT HIGH VOLTAGE TO THE LOAD CENTERS
SHORT SECONDARY FEEDERS CARRY LOW VOLTAGE POWER TO THE LOADS

Dependable G-E distribution system takes power up to 13.8 kv in your plant to substations near electrical load centers where voltage is reduced to utilization levels, and fed to motors by short feeders.

G-E Switchgear Insures Strength & Safety

New flame-retardant material insulates circuit breaker. Totally-enclosed bus compartments. *Simple Operation & Inspection:* new magne-blast circuit breaker has maximum number of parts interchangeable among breakers of various ratings.

Faster-acting elevating mechanism, visible primary contacts in disconnect position. *Plus* . . . natural-draft ventilation, easier-to-read instruments, effortless breaker raising and lowering, simplified contact design.

G-E Capacitors often pay for themselves in 2 Years or Less!

G-E capacitors increase your power factor. With a power factor clause or kva demand clause in your utility contract, increased power factor means substantial savings. Also, G-E units help circuits handle more load, raise voltage, improve motor operation.

See your G-E representative for more facts. Or write International General Electric Co., Apparatus Sales, 570 Lexington Ave., New York 22, N. Y., U. S. A.

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GENERAL ELECTRIC

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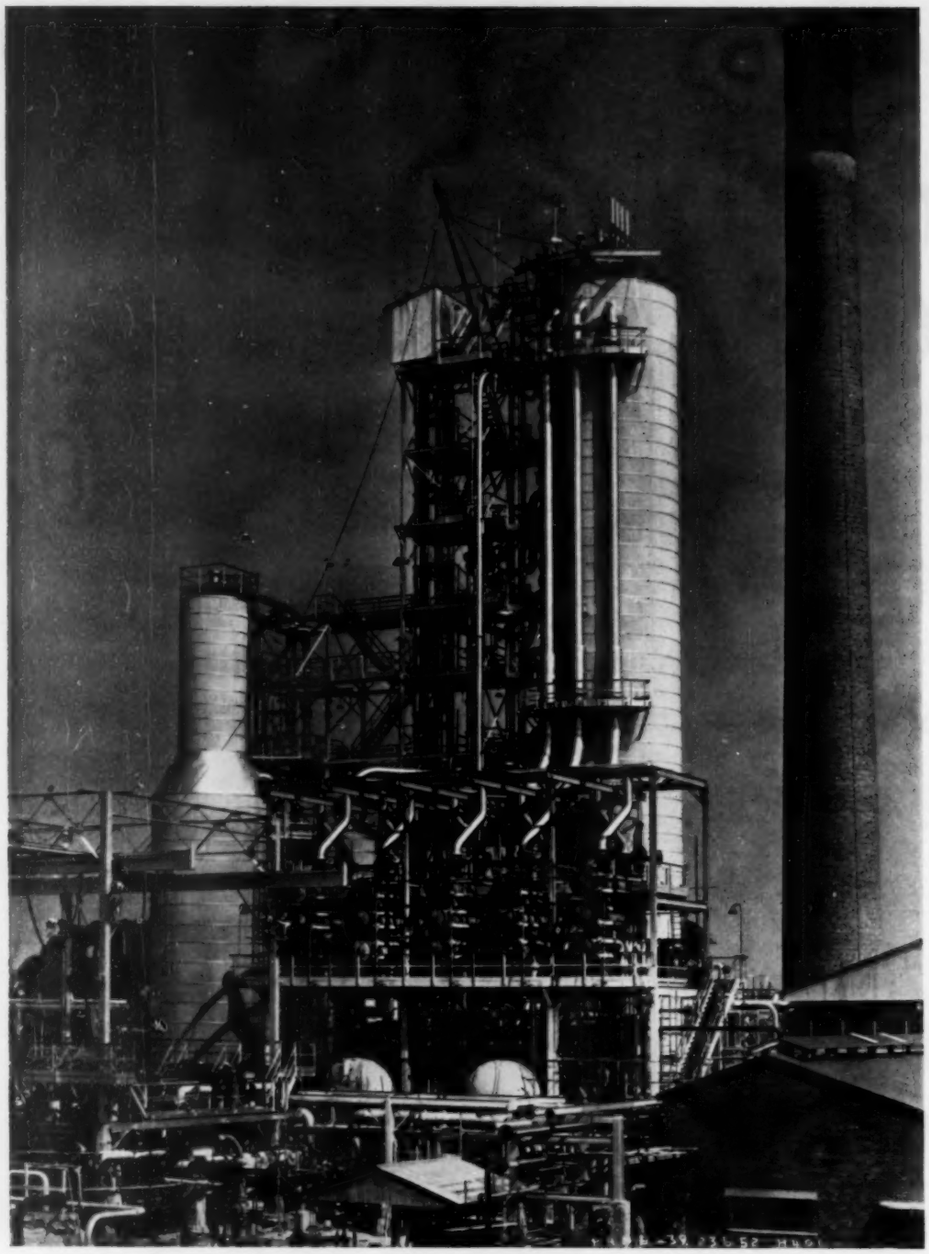

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OVERSEAS AT:

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AUSTRALIA · MALAYA · JAMAICA
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THE WIMPEY ORGANISATION HAS SUCCESSFULLY CARRIED OUT EVERY ASPECT OF WORK CONNECTED WITH OILFIELD DEVELOPMENT, REFINERIES AND OIL PORT INSTALLATION AT HOME AND OVERSEAS

GEORGE WIMPEY & CO., LIMITED, HAMMERSMITH GROVE, LONDON, W.6

Perfect example

Here is a perfect example of a business in which the service is as important as the product itself.

There is nothing in the book to stop you from packaging all your lubricants and saying to the car owner: "Here's your grease and oil—put 'em in yourself!"

However, mighty little oil business is done that way. The reason—your business is essentially a *service* business.

So is ours.

From the beginning we have realized that if "Ethyl" antiknock compound was to be of greatest value to refiners, it had to be accompanied by broad-gauge service. So we have developed many programs of service to the Canadian petroleum industry.

For example, Ethyl's technical services, road testing, gasoline testing, blending and safety programs all help Canadian refiners produce high-quality regular and premium fuels.

Ethyl's fleet programs for bus and truck operators, and our farm-tractor program help refiners maintain satisfied customers.

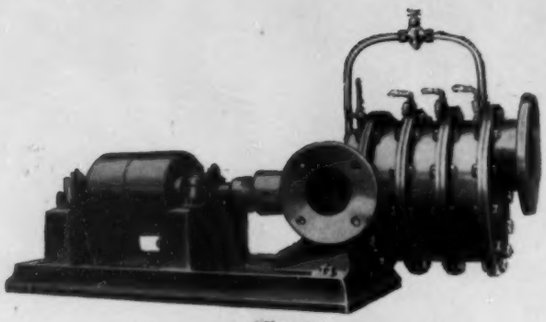
We are active at the retail level, too, with a varied program of dealer training aids. There are movies, booklets and "live" demonstrations, like the Product Sales Clinic, which will be seen by most Canadian dealers, salesmen and marketing men by the end of this year.

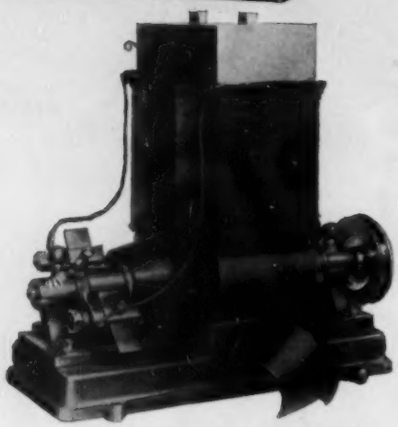
What makes all these services especially valuable to Canadian refiners is that the recommendations of Ethyl Antiknock, Ltd., are based on vast funds of antiknock data and experience developed over thirty-one years.

In our book, *service* will always be regarded as important as the product.

ETHYL ANTIKNOCK, Ltd.

44 KING STREET WEST, TORONTO, ONTARIO





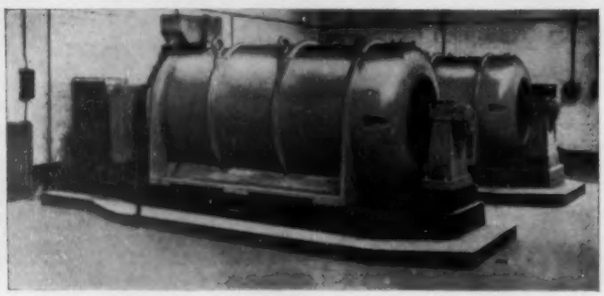
—1858

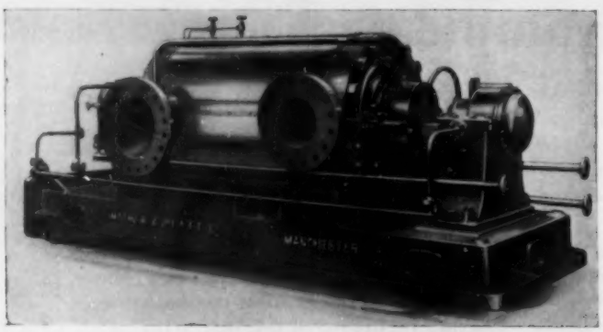
A GREAT PAST

——1882

Mather and Platt were making centrifugal pumps in 1858. The first Mather-Reynolds Turbine Pump, illustrated at top left, was patented in 1876. A few years later—in 1882—the company entered the field of Electrical Engineering and the inventive ability of Thomas A. Edison and the scientific attainments of Dr. John and Dr. Edward Hopkinson were combined to produce the first electric generators which can rightly be said in the technical sense to have been designed. The illustration on the left shows an early Edison-Hopkinson machine built by Mather and Platt.

A RENOWNED PRESENT . . .





The present day products of the Pump and Electrical Departments of Mather and Platt Ltd. are in every sense worthy of this long tradition. The bottom photograph shows a modern "Plurovane" pump built for main line work, moving a throughput of 50,000 bbls. per day of crude oil against a pressure of 750 p.s.i. when running at 1,500 r.p.m. The photograph above it shows Mather and Platt totally enclosed flame-proof motors, also engaged on main-line duties. They are of 1,000 h.p. capacity 1,480 r.p.m. fed from 3 phase 50 cycles 6,000/6,600 volt supply. They are squirrel cage machines, direct-on started with a starting current four times full load value.

. . . and an ambitious Future

CENTRIFUGAL PUMPS FOR MAIN PIPE-LINE DUTIES: FOR TRANSFER AND LOADING DUTIES: FOR REFINERY PROCESSES. ELECTRIC GENERATORS AND MOTORS FOR ALL DUTIES.

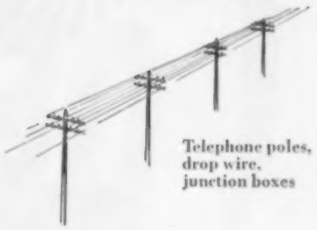
MATHER & PLATT LTD. **PARK WORKS, MANCHESTER 10**
Park House Gt., Smith St., London S.W. 1

Microwave radio relay system

Switchboards, test boards

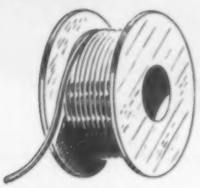
Insulators and all pole-line hardware

Telephone batteries and standby power supplies

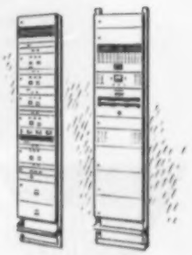


Telephone poles, drop wire, junction boxes

Teleprinters



Wire and cable for every purpose



Carrier wire transmission systems

EVERYTHING...behind your telephone

Modern automatic dial telephone exchanges—for communities of any size from the largest to the smallest—are provided complete to the last detail by ISE. But ISE service goes far beyond that—covering every conceivable need of a modern communications system. Included are such specialized equipment as microwave point-to-point links, carrier and other multiplex systems and teleprinter networks—as well as the telephone wire itself, the poles on which it is strung and all the tools, accessories and materials required. Look to ISE for everything—everything behind your telephone.

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an IT&T ASSOCIATE

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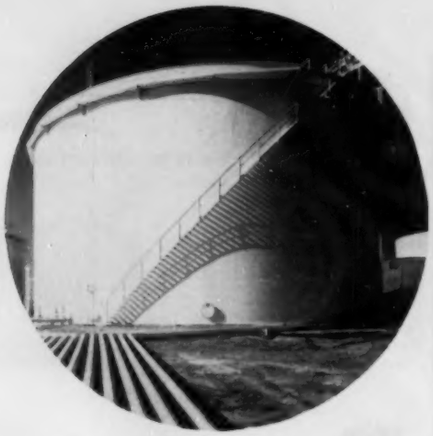

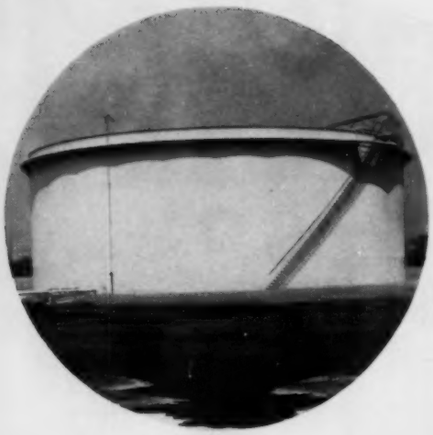

PROVEN SAFE, ECONOMICAL,
DEPENDABLE IN USE!
USED ALL OVER THE WORLD

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GENERAL AMERICAN
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By GENERAL AMERICAN

The Wiggins roof floats on the surface of a stored product and the triple seal protection turns practically all pumping and standing losses into savings. Simple design keeps maintenance low. Tested and approved under all weather conditions.

Only the Wiggins Floating Roof has all the specifications which 30 years' experience has proven necessary for best performance.

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A Great New Motor Oil to Build New Business

VEEDOL 10-30

Your Customers Get

HIGHEST OCTANE PERFORMANCE

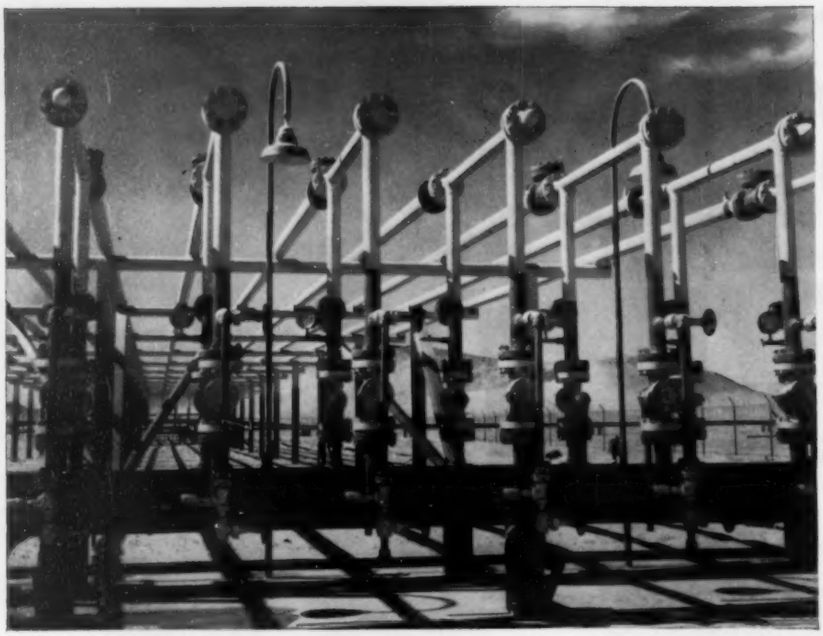
And up to 40 MILES MORE per tankful of gasoline.

New VEEDOL 10-30 pulls in traffic because motorists know it steps up engine performance. The reason is that VEEDOL 10-30 is a refined 100% distilled oil which cuts down to a minimum octane-robbing carbon deposits ordinary motor oils build up.

VEEDOL 10-30 in the crankcase means greater gasoline mileage, too... up to 40 extra miles per tankful. The reason is *lower fluid friction*... less oil drag. Quicker starts, quieter hydraulic valve action and longer engine life are other benefits from this Extra High Detergency Motor Oil. Put up a VEEDOL display and pull in extra sales!

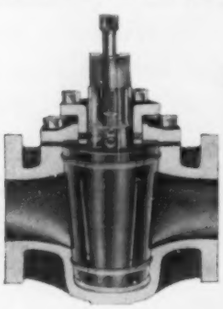
TIDE WATER ASSOCIATED OIL COMPANY

New York Tulsa San Francisco



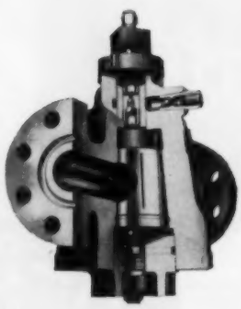
These lubricant sealed Audco-Nordstrom valves will stay dependable—even in the cruel climate of the Saudi Arabian desert.

Out of sight and out of mind. These Audco-Nordstrom valves are sealed against the hot, abrasive sands and always ready for instant operation.



Cutaway view, Standard bolted gland Audco-Nordstrom valve.

Cutaway view, Hypreseal type Audco-Nordstrom valve for higher pressure service.



UNDERGROUND LINES AND SEPARATION LINES IN SAUDI ARABIA

AUDCO-Nordstrom

VALVES... FOR DEPENDABLE YEAR IN, YEAR OUT SERVICE

Petrochemical and petroleum engineers all over the world depend upon Audco-Nordstrom valves for year in, year out trouble-free service. Experience has taught them that in every operation—from huge petrochemical installations to remote desert pipe lines where valve failures could be disastrous—Audco-Nordstrom valves can always be depended upon to do the job.

A unique lubrication system is the key to the efficiency and dependability of the Audco-Nordstrom valve—whether it is operated a hundred times a day or once a year. The lubrication—under pressure—does three important things that you can't expect in ordinary valves: (1) eliminates the wearing friction of metal working surfaces and assures really long valve life; (2) allows the plug to be hydraulically jacked for instant, one-quarter turn operation; and (3) provides a positive seal against leakage of even the lightest gases. It's easy to see, then, where dependability is a must and efficiency is crucial . . . you'll find Audco-Nordstrom valves.

Write for descriptive literature today. Find out how Audco-Nordstrom valves will provide economical, dependable, maintenance-free service for you.

AUDCO and Nordstrom

BRITISH

AUDLEY ENGINEERING COMPANY, LTD.

Newport, Shropshire, England

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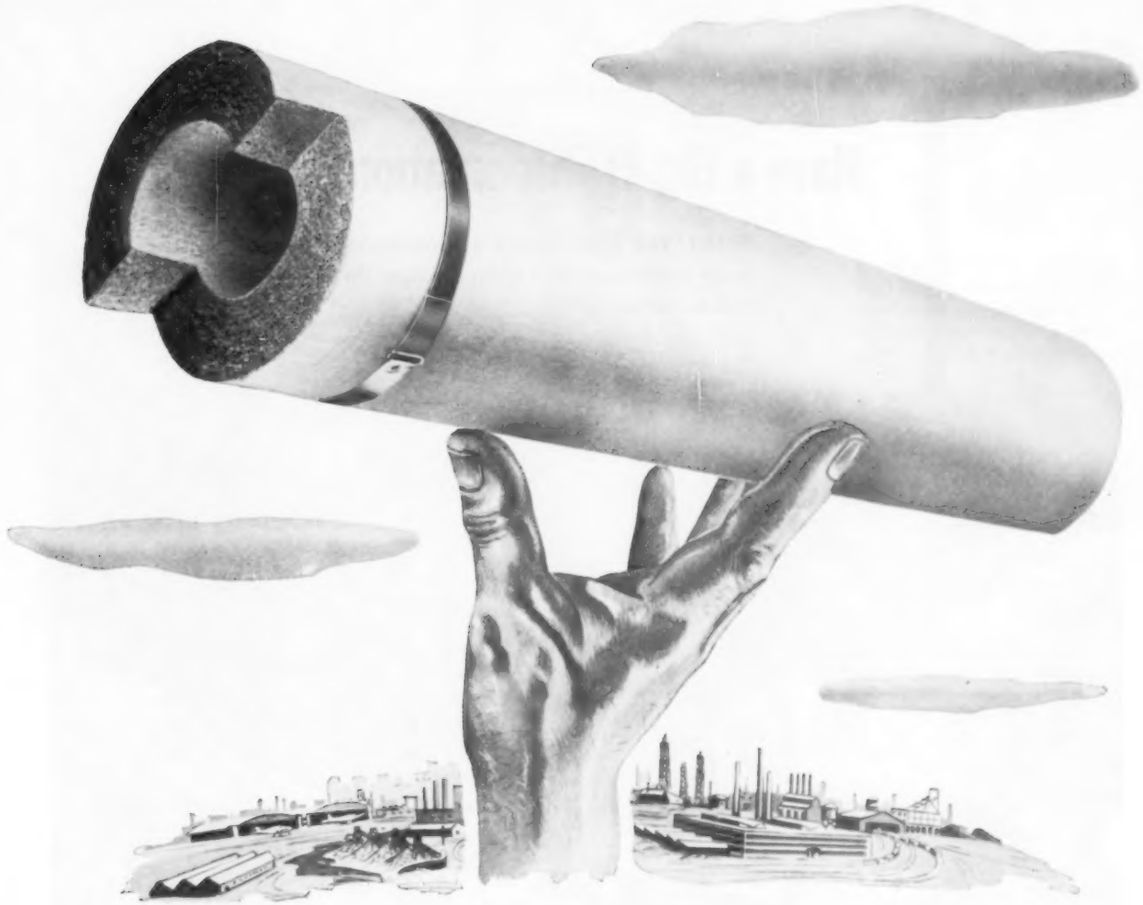
OVERSEAS AGENTS located in South Africa, Australia, India, Trinidad, British West Africa, Finland, Norway, Sweden, France, Belgium, Switzerland, Italy, Spain and Portugal.

EXPORT: International Division, Rockwell Manufacturing Co., 7701 Empire State Building, New York 1, N. Y.

CANADIAN LICENSEES: Peacock Bros., Montreal, Quebec.

ROCKWELL



NEW HORIZONS

ATLAS INSULATIONS *All Across Canada*

Many of the Dominion's largest oil refineries are insulated with Atlas Asbestos materials. "Atlasite", an Atlas developed insulation, in pipe, block and sheet form, is time-proven under many service and climatic conditions. Atlasite's temperature range is up to 850°F./Newall's 85% Magnesia up to 600°F and Newall's Newtempheit up to 1625°F are also in service in Canada's largest developments.

ATLAS ASBESTOS MANUFACTURES AND APPLIES
THESE MATERIALS RENDERING A COMPLETE INSULATION SERVICE

For Data and Information, Write to 5600 Hochelaga St., Montreal.

IMPERIAL OIL
LIMITED *(ESSO)*

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ATLAS ASBESTOS COMPANY LIMITED
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A Member of the Turner & Newall Organization

Have a Big Transportation Problem?

WHATEVER your trucks are transporting, you need the most modern power equipment to do the job efficiently and economically.

This Model WC-2264T White Tractor moved a 50,000 gallon storage tank to exact unloading position, turned it over to modern materials handling equipment with substantial time savings... no lost motion... no doubt about the job being done.

WHITE TRUCKS

cut hauling costs

TOUGH hauling jobs like this one call for all the stamina and rugged construction you can get in a motor truck.

And they call for a truck engineered right to your exact operating needs for greatest efficiency and economy in the work to be done.

That's why you see so many White Trucks in all parts of the world... on toughest operating assignments of all kinds...saving time and cutting costs wherever they serve.

White Quality tailored to *your* work requirements gets more work done... in less time... at lower cost.

Your White Representative will be glad to provide facts about the advantages of White Specialized Design for your business. Call or write him today.

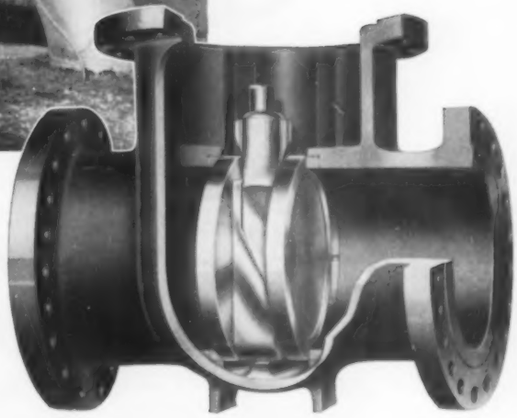
THE WHITE MOTOR COMPANY • *Cleveland 1, Ohio*

EXPORT DIVISION CABLES: WHITCO

FOR MORE THAN 50 YEARS THE GREATEST NAME IN TRUCKS

White

Darling 20" fully revolving double disc, parallel seat cast steel gate valves, with manually and motor-operated bevel gear, installed on a major line.



Darling cast steel pipe line gate valves

Rated tops at keeping out of trouble!

IT won't cost you a cent to find out *why* you stand to save plenty with Darling pipe line gate valves on the job. Aside from extra rugged, stress-proved construction throughout, it's Darling's unique fully revolving double disc, parallel seat principle that *really* pays off!

Take a close look at the cutaway view. The rugged, self-adjusting wedges *automatically* seat the fully revolving, no-pocket discs, assuring tight, easy closure. Coupled with uniform wear distribution, these valves do a better job and last longer with less attention, less maintenance.

If it's proof of performance you're after, check with some of Darling's pipe line users. Meanwhile, you are welcome to a descriptive bulletin giving *all* the money-saving facts. Darling gate valves are available in all pressures and various constructions for main line, gathering, manifold, tank farm and all other services.

for plus values job-proved again and again

For Darling Water Works Valves and Hydrants, contact The Canada Valve & Hydrant Co., Ltd., Brantford, Ontario.

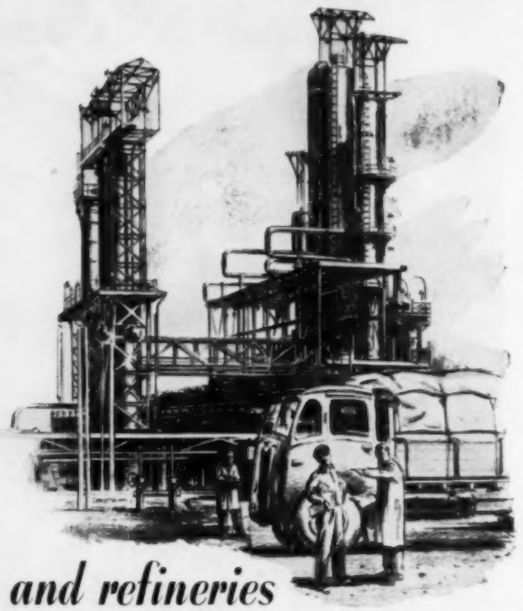
SANDILANDS VALVE MANUFACTURING CO., LTD.
Galt, Ontario, Canada

Wheels of industry the world over are turned

by

B
T-H

ELECTRIC MOTORS



in oilfields and refineries

Whenever a power drive is needed, there is a BTH motor that will do the job efficiently and economically. In industries all over the world, BTH motors are helping to increase production. Over half-a-century's experience of this branch of electrical engineering enables BTH to offer the motor with the mounting, enclosure, rating and performance best suited to the application.

BTH factories are exceptionally well equipped to make both ***STANDARD*** *and* ***SPECIAL*** *machines in large quantities*

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*FIRST LINE *Extended-Surface* HEAT EXCHANGERS

ASK THE AEROFIN MAN

Specify Aerofin and you specify high efficiency, long service life and low maintenance and service costs.

Take advantage of Aerofin's unequalled experience, production facilities, and materials-testing and design research—of Aerofin's complete engineering service at the plant and in the field.

Ask the Aerofin man.

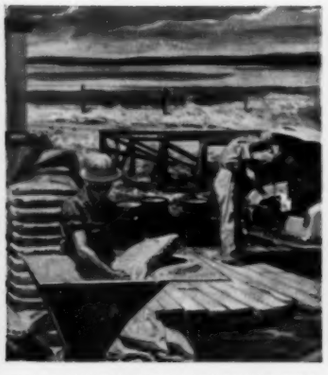
* Aerofin makes extended heat surface exclusively — not as a by-product, not as a side-line. Sold only by manufacturers of fan-system apparatus. List on request.

AEROFIN CORPORATION
410 South Geddes St., Syracuse 1, N. Y.

Pacific Pumps inc.

IS ONE OF THE DRESSER INDUSTRIES

Pacific Pumps Inc., of Huntington Park, California, has grown from a small group of six men in 1923 to one of the leading manufacturers of custom-built centrifugal and steam-turbo pumps in the United States. Pacific also licenses several manufacturers abroad. Superiority of design, engineering, quality and workmanship has elevated Pacific Pumps to a position of pre-eminence and leadership in the international petroleum and processing industries.



MAGNET COVE BARIUM CORP., Houston, Tex., Malvern, Ark. Magcobar drilling mud, Magcogel bentonite, Mylojel, Fiber Seal, Jel-Oil mud.

CLARK BROS. CO. DIVISION, Olean, New York. Engines and compressors—gas, steam and diesel driven.

DRESSER MANUFACTURING DIVISION, Bradford, Pa. Oil and gas pipe couplings, fittings and sleeves—rolled and welded rings—welded fittings and flanges.

KOBE, INC., DIVISION, Huntington Park, Calif. Complete hydraulic oil field pumping systems, including the Kobe Free Pump.

No. 7 in a series about Dresser Industries

What is the DRESSER plus+?

The Dresser Plus is the extra *service* you get when you deal with any Dresser company. It is an added advantage for you which stems from Dresser's unique overall organization. For Dresser is many companies with a single purpose—to provide the growing oil and gas industries with operating equipment that is *second to none.*

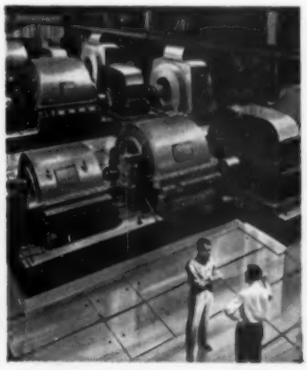
Each company in the Dresser group functions independently within its own specialized field—yet each can draw from the total resources, in manpower, research, and know-how, of the combined Dresser operations. When you work with any of the Dresser companies, all of the facilities of Dresser are *at your service.*

Planned, coordinated specialization—company by company—"one for all and all for one"—that is the DRESSER PLUS +

In the Utility, Industrial, Marine Service and other industries where steam generating is required, Pacific Custom-built Boiler Feed Centrifugal Pumps have long been accepted as the criterion. Pacific Pumps Inc. also operates an independent division (within the organization) exclusively devoted to the manufacture and sale of superior oil well plunger pumps.

DRESSER INDUSTRIES, INC.
OIL, GAS AND CHEMICAL EQUIPMENT
ATLANTIC BUILDING ★ DALLAS, TEXAS

PACIFIC PUMPS, INC., Huntington Park, Calif. Centrifugal pumps, deep oilwell plunger pumps, hot oil and boiler feed pumps.



ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind. Rotary positive blowers, gas pumps, centrifugal blowers, exhausters; positive displacement meters.

SECURITY ENGINEERING DIVISION, Whittier, Calif., Dallas, Tex. Rock bits, reamers, casing scrapers, reamer rock bits, coring bits, Securaloy.

IDECO DIVISION, Dallas, Beaumont, Tex. Derricks, drawworks, rambler drilling rigs, traveling blocks, rotary tables.

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EXPERIENCE MAP OF SOUTHERN'S SUPERVISORY STAFF
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PETROCHEM-ISOFLOW FURNACES
are most efficient by any comparison

Uniform Heat Distribution • Maximum Fuel Efficiency
Minimum Ground Space • Low Maintenance • Zero Air Leakage
Low Pressure Drop • Explosion Resistant
Short Length of Liquid Travel • Excess Draft for High Overload
Plenum Chambers for Hazardous Areas
Simplicity of Design and Construction
are Petrochem-Isoflow design factors which provide
operating performance most efficient by any comparison.

The Isoflow Heater basically is a circular steel shell; this results in an explosion-resistant structure. The shell is lined on the inside with insulation and insulating refractories; this results in a wall with a zero air leakage and high efficiency. The vertical tubes are combined with integral convection tubes; this results in less headers in the heaters for complete cleanability. The integral radiant convection tubes and minimum number of headers result in a minimum pressure drop for a given velocity. The vertical tubes completely shield the walls resulting in low wall maintenance. The small number of headers in combination with the vertical tubes result in ease of cleaning and, if desirable, gang-cleaning of several tubes simultaneously. Individual burners, symmetrically spaced with relationship to the tubes, results in even heat distribution horizontally. The reradiant cone effects even heat distribution vertically. Segregated burners result in ease of firing and inspection of burners. These are some of the design features which place Isoflow Furnaces in a class of their own.

More than 1200 are in operation throughout the world
in the petroleum, chemical and allied industries . . . for all processes
and for any duty, pressure, temperature and efficiency . . .
and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.

PETROCHEM-ISOFLOW FURNACES
UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

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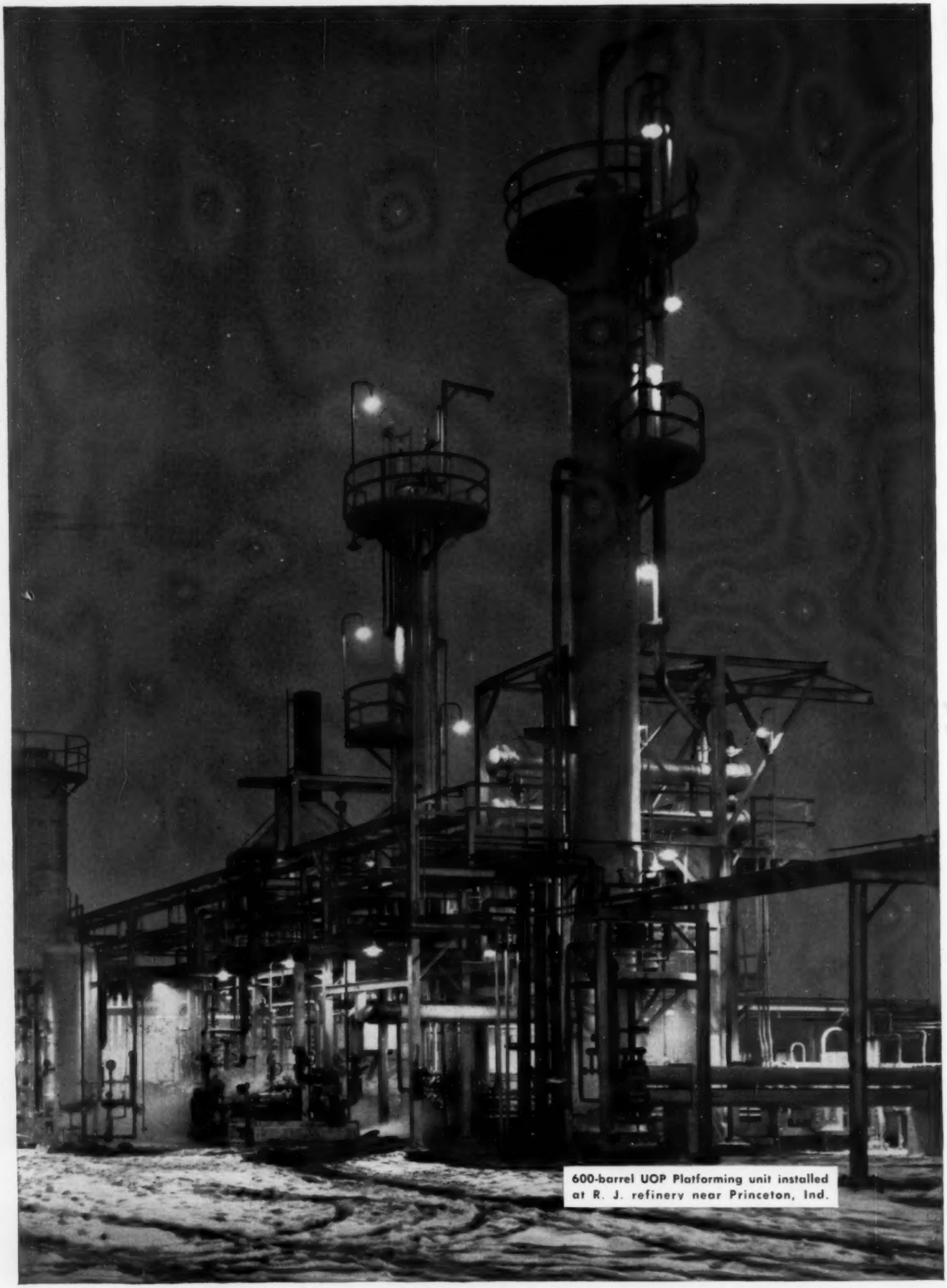
Foreign Licensees: England – BIRWELCO, LTD., Birmingham 6 • France – HEURTEY & CIE, Paris • Germany – DR. C. OTTO & COMP., Bochum



600-barrel UOP Platforming unit installed at R. J. refinery near Princeton, Ind.

PLATFORMING CHANGES MARKETING METHODS OF R. J. OIL & REFINING CO.

By Henry P. Smith, President
R. J. Oil & Refining Company, Inc.

HIGH quality products being produced in our new UOP Platforming unit have given R. J. new stature in its marketing area and have brought about sweeping changes in marketing techniques.

Henry P. Smith

Before the Platforming unit went on stream at our refinery near Princeton, Ind., R. J. sold premium and regular gasolines at prices lower than those posted at the wholesale outlets of other oil companies.

Now, because R. J.'s gasolines have the highest octane ratings of any in our marketing area, we are commanding prices on a par with those of other companies. And a new theme song—"Fill 'er up and feel the difference"—is being chanted by motorists patronizing our stations.

Motorists are enthusiastic in their praise of the new "Platolene" premium gasoline and "500" regular—both products of the UOP Platformer.

Gasoline sales have nearly trebled since September 5, 1953, when the Platforming unit went on stream. A credit card system was established recently, and already 200 motorists in the 100-mile area R. J. serves have availed themselves of this service.

First Standard "A" Unit

The process design for the Platforming unit was handled by Universal Oil Products Company engineers. All of the mechanical design and drafting, purchasing, and construction were handled by Procon Incorporated. The unit is the first "package" installation of a Standard "A" UOP Platforming process unit.

The decision to install the Platforming unit was made after careful investigation convinced R. J.'s management that it was the ideal catalytic reforming process which would enable the company to become a leader in a marketing area where the race for higher octanes was constantly increasing.

Other factors which motivated our decision were:

—We felt that Platforming would give R. J. a more marketable product.

—We were convinced R. J. could abandon its below-market price policy because of high quality products without suffering a loss in sales.

—We believed that a Platforming unit would give the refinery sufficient flexibility so that the company could always stay on top in the octane race.

—UOP's long record of giving service to licensees.

R. J.'s Platforming unit is equipped with a desulphurizer. Raw charge consists of 400° F. straight run gasoline which goes from storage to a heater, the desulphurizer and then to a prefractionating column.

A cut of approximately 270° F. end point is removed overhead from the prefractionator. The reactor charge, taken as a sidecut from the prefractionating column, is of 400° F. end point material. The sidecut goes from the reactor charge pump through three heaters and reactors.

Recycle Gas Through Reactor

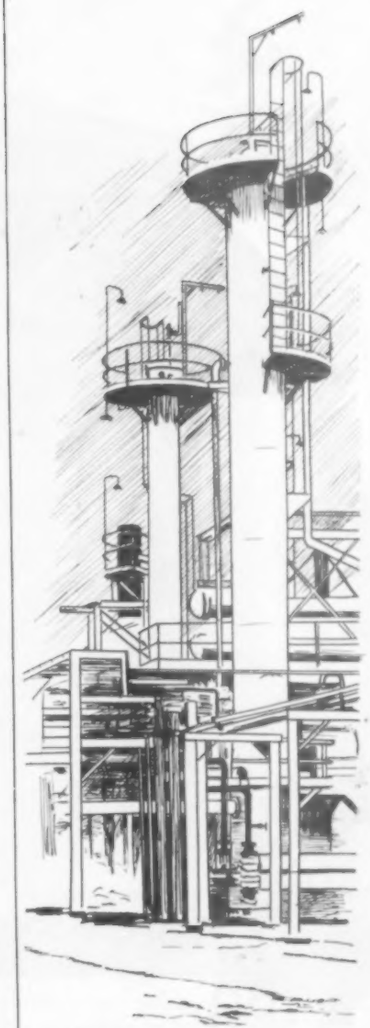
After passing through the No. 3 reactor, the material is sent to a products separator. The compressor takes suction from the top of the separator and recycles the gas through the reactor section.

The liquid bottoms product from the separator is charged to the stabilizer together with overhead material from the prefractionator. Stabilizer effluent is pumped to storage as marketable products.

Sulphur content of the charge stock is converted in the desulphurizer into H_2S, which in turn is removed from the prefractionator in a net overhead cut. The H_2S is removed overhead when this cut is charged to the stabilizer. Gas from the stabilizer is sent to a gas balance drum before being injected into the refinery fuel gas system.

R. J. has spent nearly $1,000,000 to bring to its motoring public the finest gasoline that can be produced. Because of the increasing demand for our gasoline and other products, we are contemplating an extensive expansion program. Present plans call for doubling the size of the Platforming unit from its present 600 B/SD capacity. It is hoped that this expansion program will be completed by late 1954 or early 1955.

It is our firm belief that Platforming has made R. J. an increasingly important factor in the economic life of southwestern Indiana, and that the company will continue to grow and prosper because of the superior quality of its products made possible by Platforming.



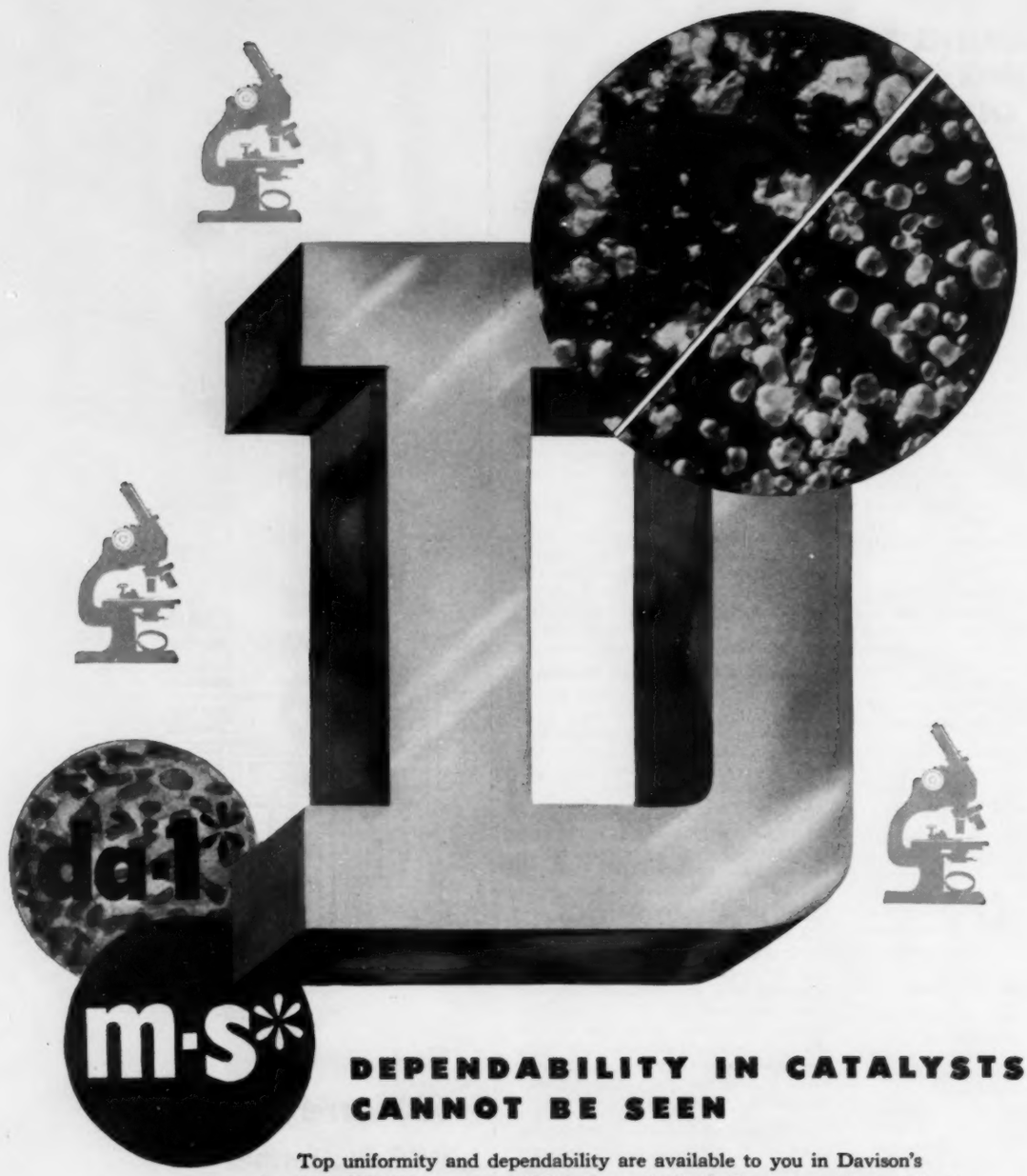
first
600 barrel
UOP Platformer
on stream

designed, engineered and licensed by

UNIVERSAL
OIL PRODUCTS
COMPANY

30 ALGONQUIN ROAD,
DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

Universal Service
Protects Your Investment



DEPENDABILITY IN CATALYSTS CANNOT BE SEEN

Top uniformity and dependability are available to you in Davison's microspheroidal (M-S*) or ground (DA-1*) synthetic fluid-type cracking catalysts. The accompanying photomicrographs show the physical characteristics of the DA-1 and new M-S catalysts produced in Davison's Cincinnati plant. Uniform physical and catalytic characteristics result from Davison's modern facilities and years of technical experience and research. Experienced Davison Field Service Engineers—complete laboratory facilities—are all part of Davison Dependability—Dependability with the big "D".

*T.M.T.D.C.C.

Progress Through Chemistry

Chemical Progress Week
May 17-22

THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

REGINA, SASKATCHEWAN. Now on stream at Imperial Oil Company's refinery at Regina is this $5 million addition consisting of a Vacuum Flash unit, a 13,600 barrels per day Fluid Catalytic Cracking unit (Model IV) and gas recovery systems — designed, engineered and constructed by Fluor of Canada, a subsidiary of The Fluor Corporation, Ltd. The plant, engineered for extreme variances in weather conditions, was completed on schedule and converts reduced crude oil to high quality gasoline and heating oils.

With offices in principal cities on four continents, Fluor is one of the world's major engineering and construction organizations for the petroleum, natural gas, chemical, power and allied industries.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
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WALKIEPHONE

PORTABLE RADIO-TELEPHONE FOR OILFIELD COMMUNICATIONS

For purposes of routine inspection and maintenance the Pye V.H.F. Walkiephone makes a valuable but inexpensive addition to any V.H.F. scheme. Unimpeded by this lightweight equipment one man becomes a constant source of information and, when required, a centre of control. In places both unexpected and inaccessible the Pye "Walkiephone" ensures the smooth control of emergency operations. Robust, reliable, and economical in use, the complete equipment weighs only 10½ lbs. with batteries.

Telecommunications

Pye (New Zealand), Ltd., P.O. Box 2839, Auckland, C.1, New Zealand.

Pye Canada, Ltd., Ajax, Ontario, Canada.

Pye-Electronic Pty., Ltd., 65 Park Street, Abbotsford, Melbourne, Victoria, Australia.

Pye Ireland, Ltd., Manor Works, Dundrum, Dublin, Eire.

Pye Radio & Television (Pty.) Ltd., P.O. Box 10648, Johannesburg, South Africa.

PYE LIMITED · CAMBRIDGE · ENGLAND

*catalysis** +

at Baltimore

1

hydroforming unit

3

hydrofining units

Foster Wheeler will design and construct for the Esso Standard Oil Company, at the Baltimore refinery, 3 Hydrofining units (catalyst + hydrogen) for the desulfurization and general quality improvement of napthas and heating oils . . . and a fixed-bed Hydroforming unit (catalyst + hydrogen) for Octane upgrading of heavy naptha.

These process units will incorporate the latest technological application of catalysis in sulfur reduction and reforming as developed by the Standard Oil Development Company.

FOSTER WHEELER

the complete engineering and construction service anywhere in the world

******kata*, wholly + *lyein*, to loose (Gr.)

At La Tuque, the Brown Corporation, leading Quebec pulp and paper product manufacturer relies on Shell Alvania Grease to help keep production flowing without interruption.

How to keep a wooden river running . . .

TURNING the Northern Quebec forest into pulp and paper calls for a year-round schedule—with production continuing non-stop through winter and summer weather extremes. This places a heavy strain on equipment . . . on massive log conveyors, towering "orange-peel" cranes, a multitude of motors and pumps, vacuum dryers, tractors and diesel locomotives.

Ordinarily it would take several good lubricants to protect and keep all this equipment in first class working condition. But the Brown Corporation uses one lubricant exclusively that does the whole job . . . Shell Alvania Grease.

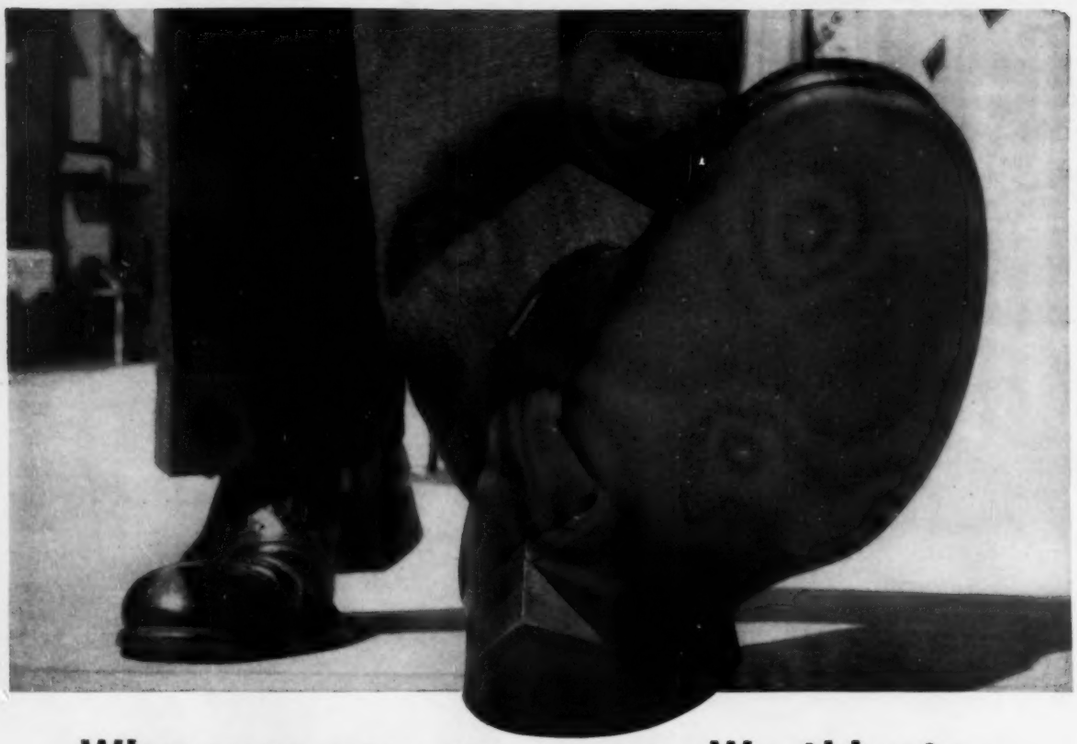
To foresee and fulfil the needs of the nation's industry is the constant purpose of Shell research. This story is yet another example of the partnership existing between the industries of Canada and Shell Oil Company of Canada, Limited.

SHELL

Shell Research leads to finer Products — *more for your money*

SHELL OIL COMPANY OF CANADA, LIMITED

IN CANADA: DIKKERS LTD., TORONTO



Wherever you are – your Worthington sales office is "just around the corner"

Whatever your business may be—manufacturing, transportation, agriculture, power, petroleum, road-building, construction, food, chemicals—the great variety of machines bearing the Worthington "wings" includes many units you require.

In addition to distributors all over the world, there are Worthington manufacturing plants in England, France, Italy, Spain, Germany, Austria, Mexico and Brazil.

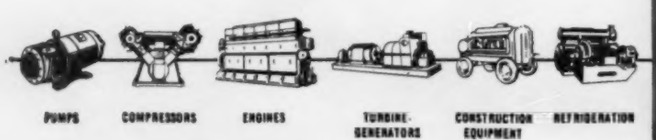
When you buy from Worthington, you have access to:

1. *One of the world's broadest lines of industrial machinery*—pumps, compressors, motors, turbines, engines, drives, air conditioning and refrigeration, and a complete line of construction equipment.

2. *An unequalled range of experience* gained in serving customers all over the world. Familiarity with actual conditions in every country.

3. *Worthington-trained local representatives* with extensive engineering experience, qualified to give technical recommendations.

Write for Worthington's new booklet, "World-Wide Operations". Worthington Corporation, Export Department, Harrison, N. J., U. S. A. F.3.26



WORTHINGTON

The Sign of Value Around the World

ALL IN A DAY'S WORK FOR *General* CREWS

Accurate, economical mapping of subsurface beds requires skilled crews, years of experience in seismograph techniques plus equipment and reliable instruments designed especially for the job. And a quick look at General's background in **all phases** of geophysical exploration is proof enough of General's ability to meet the challenges of new frontiers—whether the search be on land or at sea. When General crews are assigned to your work, you get the dependability and accuracy of exclusive climate-proofed equipment designed for on-the-job interchange of vital components, in addition to the skills of capable crews qualified by training and experience to help you explore new areas.

WHEN YOUR CONTRACT IS WITH GENERAL . . . THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR

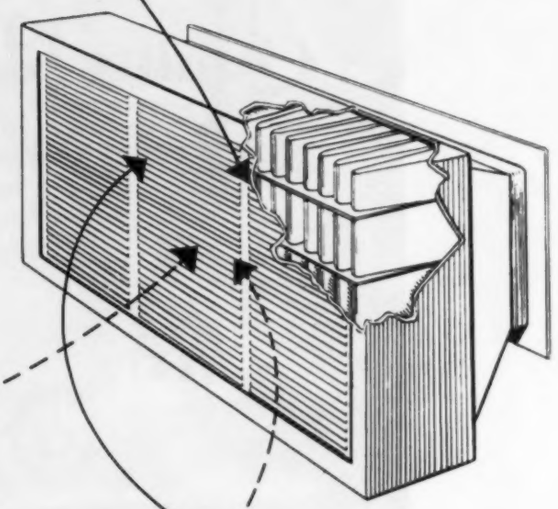
A company wholly owned by its operating personnel

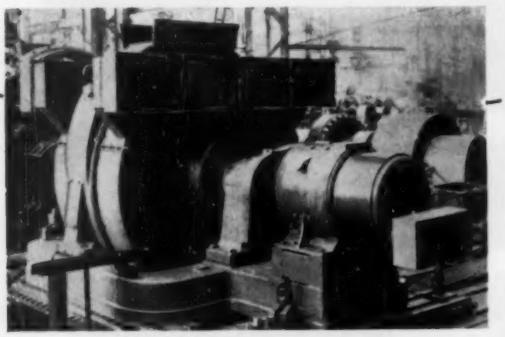
General GEOPHYSICAL COMPANY
GULF BUILDING • HOUSTON, TEXAS

VOKES FILTERS

play a vital part in keeping the oil flowing

In the blinding desert dust storms which sweep the area of the Iraq pipelines, VOKES filters have twice been chosen for the important task of protecting pumping stations and ancillary equipment . . . proof indeed of the important part which VOKES filtration is playing throughout the world in safeguarding plant and machinery from wear, breakdown and unnecessary depreciation. Below are shown three typical aspects of VOKES protection . . . protection which cannot be jeopardized by the non-availability of element replacements because VOKES FILTERS ARE CLEANABLE.



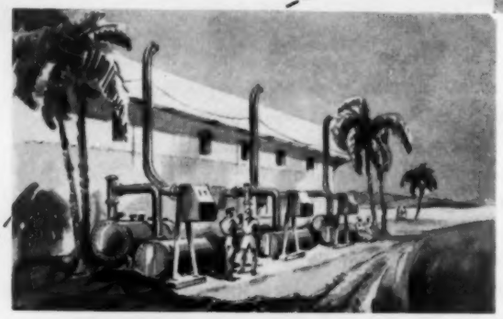


MICRO-VEE PANEL FILTERS FOR ELECTRIC MOTORS

Electric motors breathe too! . . . and these VOKES filters have proved conspicuously successful in preventing the grave damage hitherto sustained during operations in imoure air conditions.

VOKES FILTERS FOR ANCILLARY EQUIPMENT

Compressors . . . portable generators . . . welding sets . . . power packs . . . all need protection against the ingress of abrasive dust, whether by air-intake, lubricating oil or fuel.



VOKES FILTERS FOR ATMOSPHERIC AIR FILTRATION

The range of VOKES filters for air conditioning includes the Micro-vee Dry Fabric Panel Type Air Filter, which has an initial pressure drop of only 0.25" W.G. at standard ratings and can be serviced with the utmost speed and simplicity.

VOKES LIMITED

VOKES LTD. Head Office: GUILDFORD, SURREY, ENGLAND

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VI16

Integrated Refinery or Individual Plant

Recent construction at Tide Water Associated Oil Company's Avon, California refinery illustrates the flexibility of Bechtel services. Another case of "repeat business" for an old client, the contract covered major additions to a Fluid Catalytic Cracker:

... engineering and installation of new gasoline recovery facilities

... modification of existing piping

... expansion of auxiliary equipment

Bechtel performs every function required for the delivery of a complete refinery or individual units of every type—preliminary analysis to operating plant.

BECHTEL CORPORATION

SAN FRANCISCO

Los Angeles • New York

BUILDERS FOR INDUSTRY

PROCON
"OFF-THE-SHELF" DESIGNS
MEAN **Earlier on-stream time**
Accurate cost estimates
Lower engineering costs
Purchasing know-how
Proved construction techniques
Experienced field construction staffs

PROCON Builds Platformer at Pana in 7 Months

Pana Refining Company, a division of the Illinois Farm Supply Company, turned to Procon for speedy construction of the first UOP Platforming unit in the state of Illinois devoted exclusively to the production of superior quality motor fuel.

From the time the contract was signed until Procon turned the completed pressure tested 650 B/SD unit, ready for operation, over to the refinery only seven months and seven days elapsed . . . further proof that "Built by Procon" is the refiner's assurance that his construction will be handled with maximum speed, efficiency, and economy.

Procon has a WIDE RANGE of "off-the-shelf" UOP Platforming units for refiners to choose from, ranging from 600 B/SD to giant 16,000 B/SD plants.

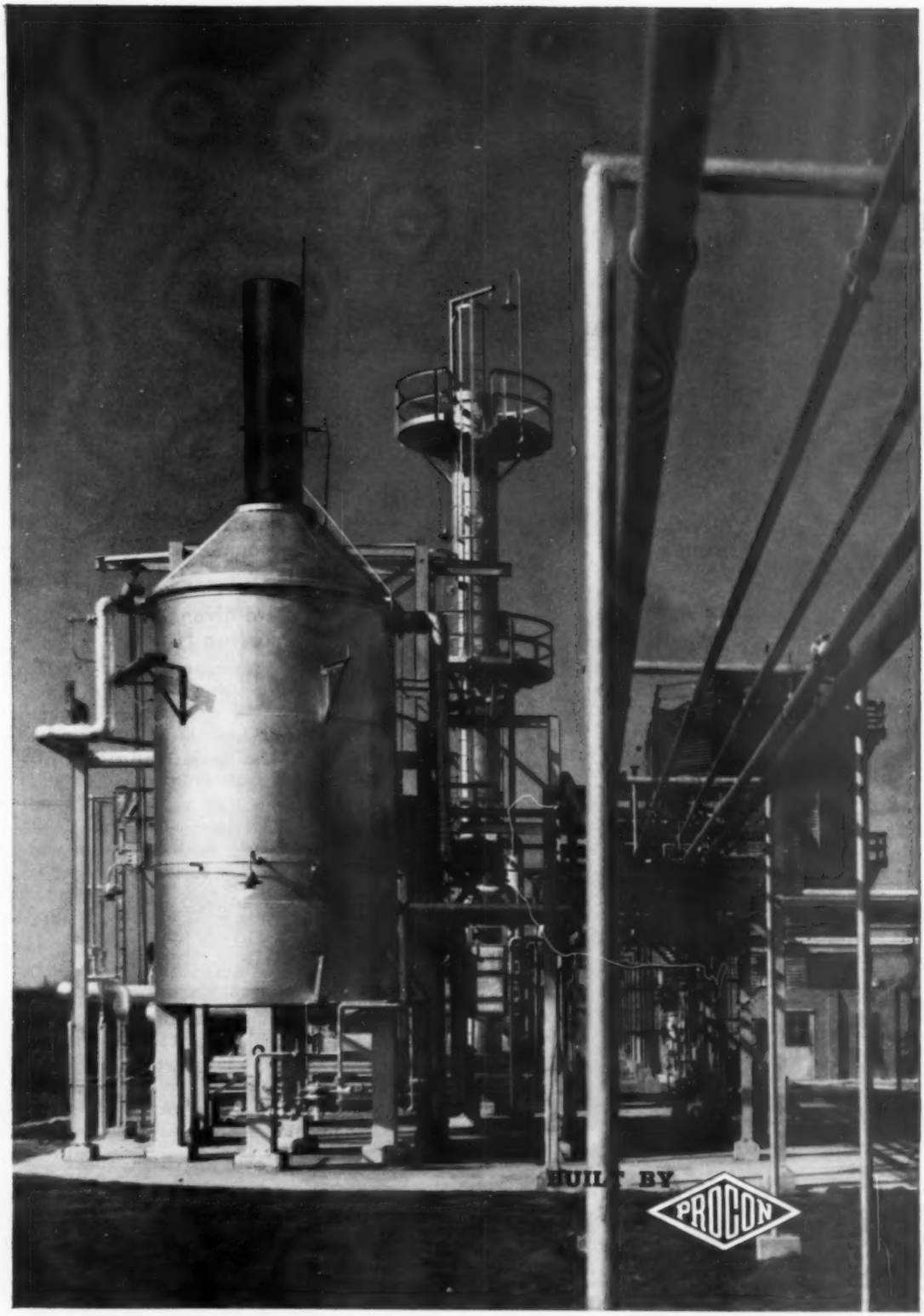
IT'S PLAIN GOOD SENSE for a refiner to use "off-the-shelf" designs when available. He thus has the assurance of earlier on-stream time, accurate cost estimates, lower engineering costs, purchasing know-how, proved construction techniques and experienced field construction staffs for his particular job.

PROCON *Incorporated*

PROCESS CONSTRUCTION
1111 MOUNT PROSPECT RD., DES PLAINES, ILLINOIS, U. S. A.

IN CANADA — PROCON (CANADA) LIMITED, 68 YONGE STREET, TORONTO 1, ONTARIO

IN ENGLAND — PROCON (GREAT BRITAIN) LIMITED, 112 STRAND, LONDON, W. C. 2


BUILT BY
PROCON

FLAMEPROOF OIL-IMMERSED SWITCHGEAR

★ Complies fully with the recommendations in the Report of the Royal Commission on "Safety in Coal Mines."

★ Covered by Buxton Certificates, Groups 1 and 2.

★ Approved breaking capacity of 25 MVA at 3.3 kV in accordance with British Standard No. 116.

★ Detachable cable box simplifies cable jointing.

★ Available in single and multiple units.

★ Lighting transformers, up to 5 kVA, can be mounted on the unit.

Full particulars are given in Technical Description No. 380.

by G.E.C.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAY-JUNE 1954

NOTES ON CUMENE

Cumene jumped into prominence during the last war when it was needed in large quantities for its anti-knock properties in aviation gasoline. More recently, renewed interest has developed in the chemical as a starting point in the manufacture of phenol.

***

To supply the sudden wartime demand for cumene, Kellogg designed and built four plants which were outstanding producers. In addition to this and subsequent post-war experience, Kellogg is currently building another cumene plant for a U. S. chemicals manufacturer as part of complete facilities for producing phenol.

***

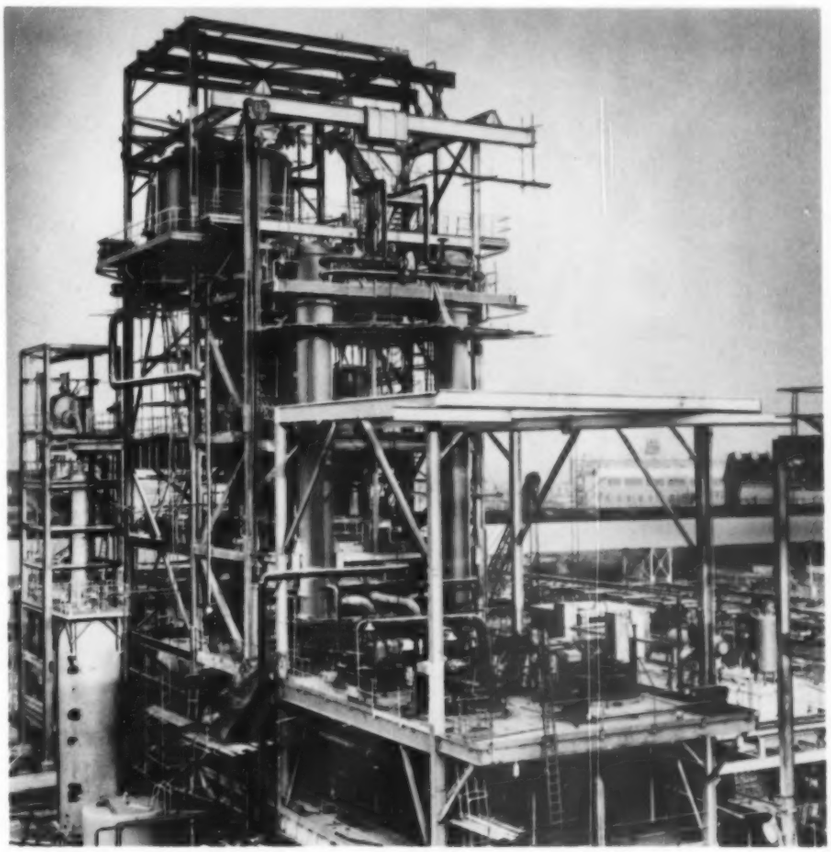
Heart of Kellogg's cumene process is a copper pyrophosphate catalyst developed in Kellogg's Jersey City, N. J. laboratory. Unique to the Kellogg process, and utilized in all of the plants the Company has built and is now building this catalyst gives the process two of its most important points of superiority —higher yields and a higher purity.

***

Copper pyrophosphate is extremely selective in the propylene-benzene reaction. Since it does not alkylate ethylene if present in the feed, high purity cumene required for phenol production can be obtained without removing ethylene from the feed or ethyl benzene from the final product, one of which steps would otherwise be required.

***

As an illustration of yield advantages, over-all conversion of benzene to cumene of other processes are described as falling in the range of 90 to 93%, based on benzene. By contrast, commercial data from Kellogg-built plants indicate yields ranging from 95 to 97% when copper pyrophosphate is emoloyed.



Lower Operating Costs, Better Yields In Fluid Phthalic Process

Two phthalic anhydride plants currently under construction in Europe highlight not only the growing importance of this chemical abroad, but also the economic attractiveness of Kellogg's Fluid process for manufacturing it.

One of the two plants which is shown in the photo above is nearing completion in England under the supervision of the Kellogg International Corporation. The other is being built for a major chemical manufacturer on the Continent. When completed, they will have a combined yearly production of more than 40 million pounds of phthalic anhydride. In both cases, the product is obtained by oxidizing naphthalene in the presence of a fluidized solid catalyst.

Kellogg's Fluid process offers a number of distinct advantages over conventional processes with fixed beds. The Fluid catalyst principle makes for improved temperature control and results in optimum operating conditions. The efficiency obtained allows the use of less air—in some cases as much as 50% less —and better heat recovery.

In addition, yields are up to 5–10% higher; the product is of greater purity: and large Fluid plants can be operated with no more personnel than are required for fixed bed units of considerably smaller capacity.

(SEE REVERSE SIDE)

CONTINUED FROM PRECEDING PAGE

New Ammonia Plant Now On Drawing Boards

Already past the chemical processing phase and well into mechanical design, Kellogg's latest anhydrous ammonia plant—this one for National Distillers Products Corporation—is now under construction at Tuscola, Illinois.

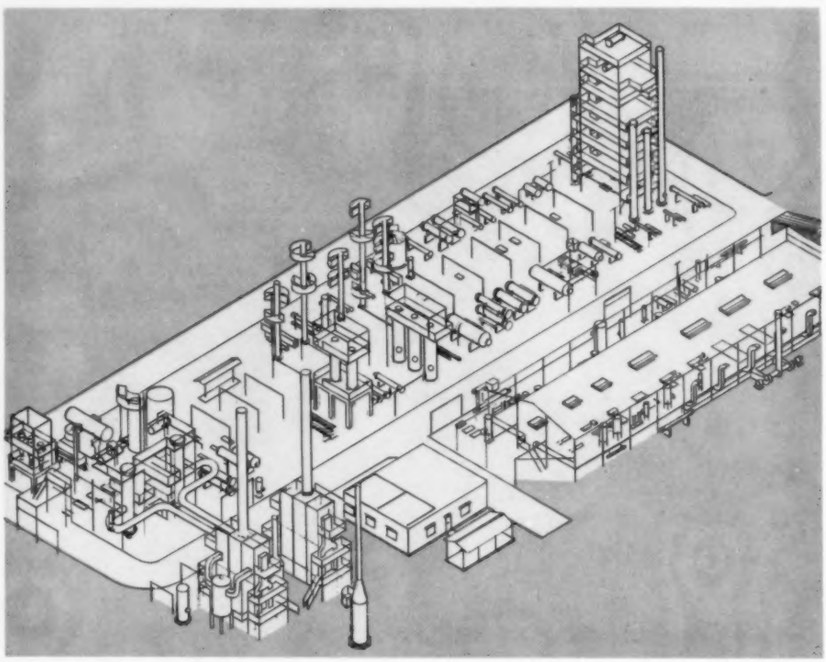
The synthesis is carried out in a step similar to that used in several previous ammonia plants built by Kellogg, the latest of which went into production a few months ago on the West Coast.

Initial operation at this West Coast plant has been more than satisfactory, demonstrating the high efficiency of Kellogg's unique quench type ammonia converter. Design guarantees have been exceeded, catalyst efficiency—even discounting the "youth" of the catalyst—has proved superior, and the product has been 99.9% pure.

Optimum Temperature Control

The Kellogg converter is designed to operate at intermediate pressures. An unusual design feature is provision for injecting quench between the catalyst beds for optimum control of temperature. Since the catalyzed hydrogen-nitrogen reaction requires a special temperature gradient for maximum conversion and since the reaction is carried out at temperatures near those at which the catalyst deteriorates rapidly, close control of temperature throughout the catalyst beds is a critical factor. Kellogg's design closely approaches the ideal arrangement for controlling the removal of heat from the converter.

The operating conditions provided—optimum reactor pressure and elimination of localized hot-spot temperatures—give the Kellogg converter its major process advantage of higher conversion per pass because reaction conditions are more favorable. At the same time these operating conditions are obtained in a converter of simplified mechanical design, resulting in reduced capital investment.



Another Ethylene-From-Petroleum Plant Gets Underway In Europe

Shown above is an isometric drawing of the pyrolysis and recovery sections of a large ethylene plant Kellogg is now building for an important European chemical manufacturer.

Demonstrating a trend abroad, this will be the second European plant to incorporate Kellogg's unique pyrolysis process for producing ethylene and other olefins. In view of decreased fuel oil demands and a sky-rocketing demand for ethylene domestically, this process is becoming increasingly attractive in the U. S. as well.

Not shown in the drawing above is the feed preparation unit which will distill the feed stock (heavy naphtha and gas oil) from crude. These fractions are then cracked in the presence of steam in pyrolysis furnaces specially designed to suppress coking—the big "bug" in conventional systems for making ethylene. Following cracking, the product stream is separated and purified in a low-temperature, low-pressure fractionation system, which was another of Kellogg's developments.

In addition to gas oil and naphtha cracking as embodied in the two European plants, the first of which has been in successful operation for more than two years, Kellogg has extended its design to include pyrolysis of ethane and propane feeds. Studies are currently underway on various heavier feedstocks.

For further information, technical data, etc., relating to chemical or petrochemical processing, write

CHEMICAL PROCESS DIVISION
THE M. W. KELLOGG COMPANY
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KELLOGG
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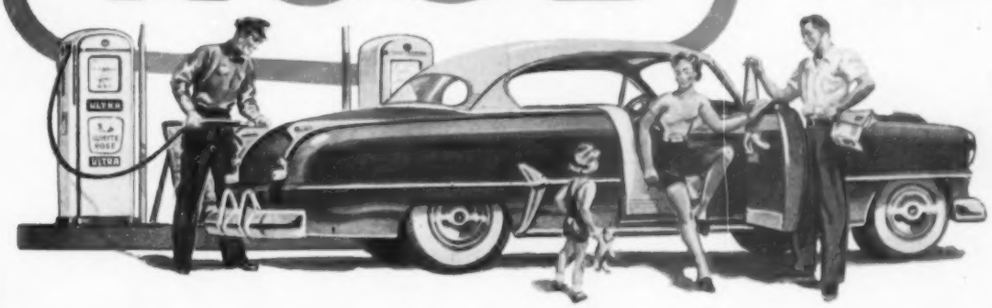
From the ROCKIES

WHITE ROSE

To the ATLANTIC



MARKING thousands of gasoline pumps from the Rockies to the Atlantic, the sign of the White Rose . . . pictured above . . . is steadily winning new friends. And no wonder! For more and more motorists every day are finding that White Rose Gasolines give *performance beyond compare!*

These fine gasolines are products of the petroleum industry's leading All Canadian company. In Canada this organization is unique. One of the country's major oil companies, it is not only *operated* by Canadians but is also 98% *owned* by Canadians.

Since the early years of this century Canadian Oil has served Canadian users of petroleum products . . . growing with Canada and prospering as she has prospered. Today prospects are brighter than ever! The entire facilities of this company are being progressively extended and amplified to meet increasing demands for its products and services.

98% OWNED by CANADIANS

CANADIAN OIL COMPANIES, LIMITED

THE ALL-CANADIAN COMPANY

Refiners and Marketers of WHITE ROSE PETROLEUM PRODUCTS

The Greater the Need for .....

Illustration shows Meadows 6GJ630 natural gas engine in self contained power plant. Developing 96 B.H.P. at 1600 R.P.M., this power plant is suitable for direct-coupled or belt driven equipment. Similar units are offered for operating on diesel fuel or gasoline.

Reliable Power

Meadows have a lifetime of experience behind them in providing reliable and economic power in far away places and under the most arduous conditions. As prime movers for oilfield equipment Meadows engines have been proved.

Manufacturers of natural gas, gasoline and diesel engines ranging from 30—300 B.H.P.

HENRY · MEADOWS · LIMITED

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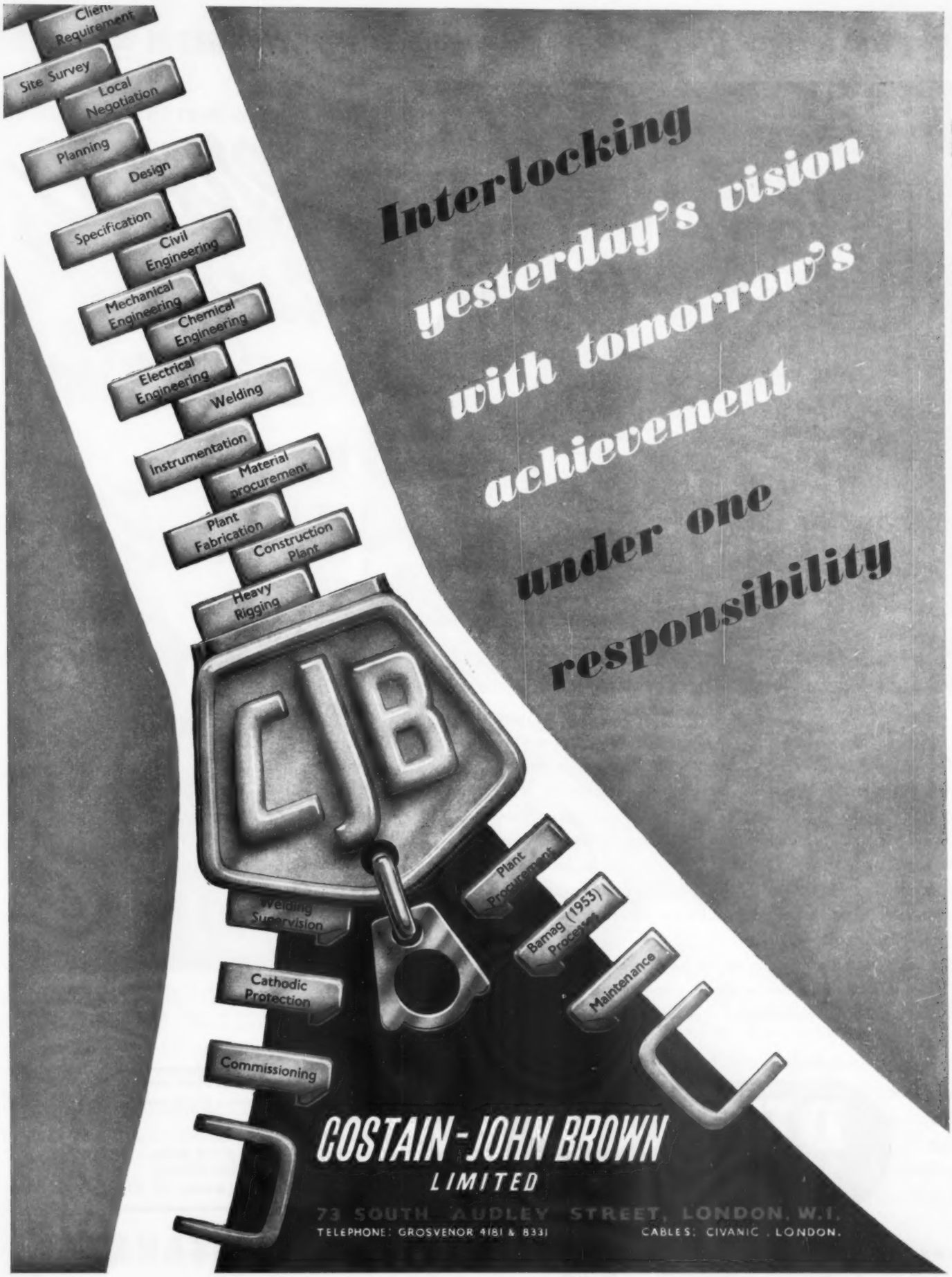
An Associated British Engineering Company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IN THE APPLICATION OF RUBBER TO OIL PRODUCTION—

Part of the Shell refinery at Cardon in Venezuela. (*A Shell photograph*)

Service assures success—

Dunlop Oil Suction and Discharge Hose to British Standard Specification 1435 Type 3. This 8" bore hose is suitable for use at working pressures up to 200 lb./sq. in. Photograph shows the hose being checked for elongation under test pressure.

The Technical Advisory Service that Dunlop offers the oil industry plays a great part in *the consistent success* of Dunlop equipment in oil installations throughout the world. Experience of installations operating in every conceivable condition enables Dunlop experts to provide thoroughly practical, up-to-date guidance on new projects, extensions, replacements, repairs and development. In this way, the most efficient use is made of equipment designed for the job with characteristic Dunlop thoroughness.

The range of Dunlop products for the industry is indicated below. To take advantage of the Service offered, simply contact your nearest Dunlop distributor or representative — or write to the address below.

DUNLOP
A WORLD WIDE SERVICE TO THE OIL INDUSTRY

OIL SUCTION & DISCHARGE HOSE, SLUSH PUMP HOSE.
INDUSTRIAL HOSES for a wide range of uses in the Oil Industry such as welding, and pnuematic tool use.
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DUNLOP RUBBER CO. LTD. (GENERAL RUBBER GOODS DIVISION), MANCHESTER, ENGLAND

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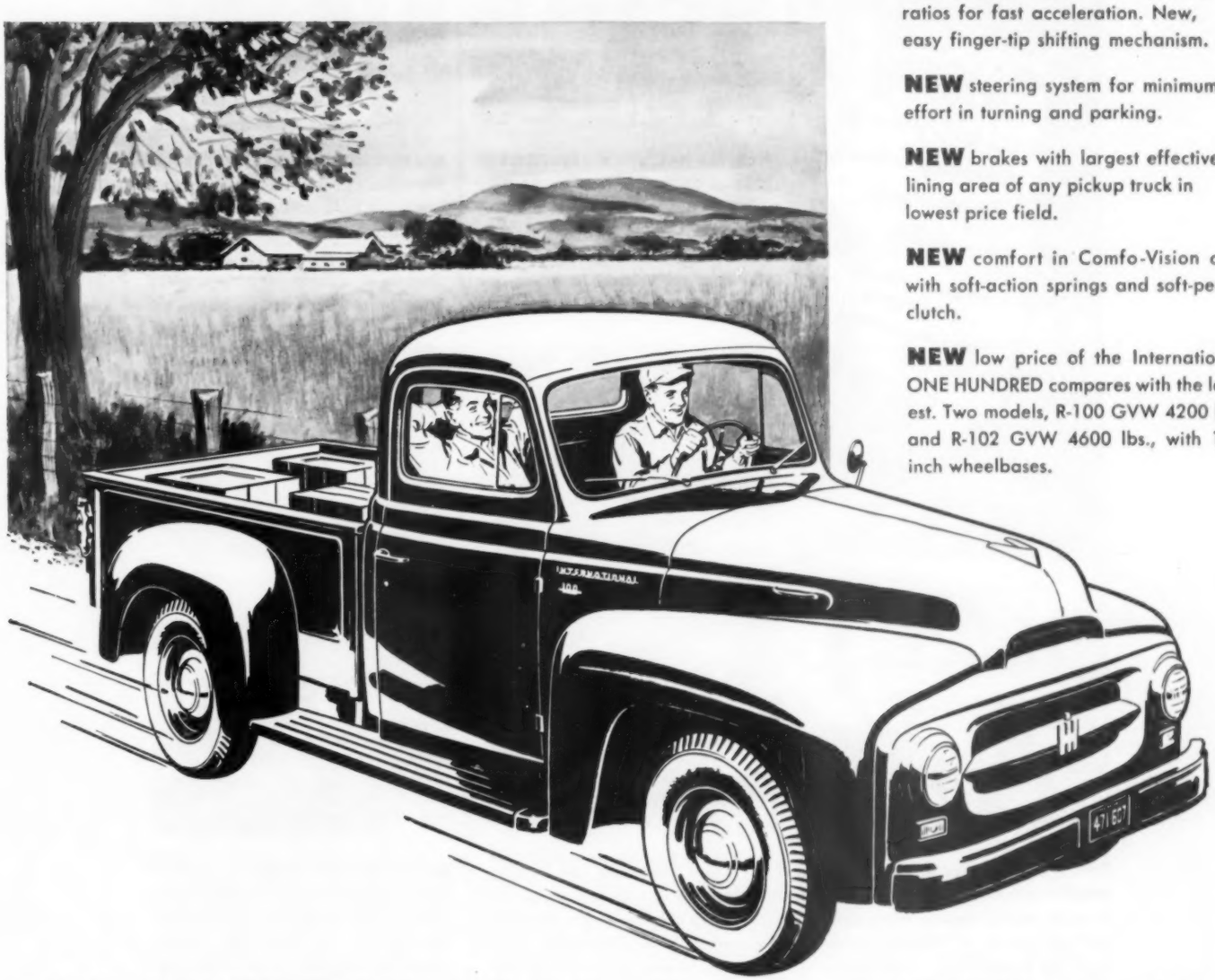
THE NEW INTERNATIONAL ONE HUNDRED!

Passenger car comfort and ease of handling with all-truck engineering



NEW economy Silver Diamond Engine with short stroke, low friction design. 104 hp., 7.0 to 1 compression ratio.

NEW transmission with improved ratios for fast acceleration. New, easy finger-tip shifting mechanism.

NEW steering system for minimum effort in turning and parking.

NEW brakes with largest effective lining area of any pickup truck in lowest price field.

NEW comfort in Comfo-Vision cab with soft-action springs and soft-pedal clutch.

NEW low price of the International ONE HUNDRED compares with the lowest. Two models, R-100 GVW 4200 lbs. and R-102 GVW 4600 lbs., with 115 inch wheelbases.

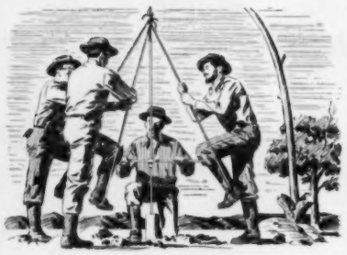
The International ONE HUNDRED is an all new ½-ton pickup truck with the comfort and ease-of-driving of a passenger car. Here are all the features you've wanted in a pickup truck . . . and all at a price that's right down with the lowest.

The new high-compression, low-friction engine gives you great new get-up-and-go plus outstanding operating economy. With the new International ONE HUNDRED you get finger-tip shifting, fast-accelerating transmission . . . new bigger brakes . . . new soft-action springs . . . and a steering system that lets you turn with little effort at corners or when parking.

Check the features and then make a date for an eye-opening demonstration. Call your International distributor today. Drive the ONE HUNDRED . . . the truck that gives you a new concept of pickup driving ease. You'll be surprised at the price. International Harvester Export Co., 180 N. Michigan Ave., Chicago 1, Ill., U.S.A.

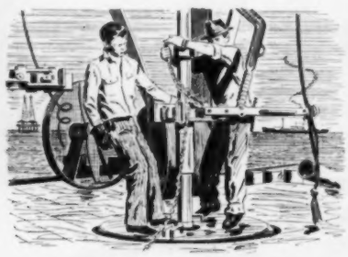
INTERNATIONAL TRUCKS

The International ONE HUNDRED is a new addition to International's famous R-110, R-120, R-130 Series of light duty trucks



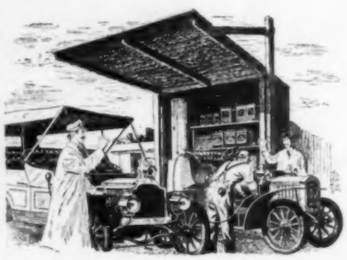
From the West's first successful oil wells of 1879, Standard's drilling operations have stretched all over the world—even in ocean depths 4 miles off shore—to get the oil which you and our friends in other free nations need more and more.

Gasoline was a waste product in Standard's first refinery of 1879, but it's king today. We've developed fuels that made better engines possible, used research tools like the chassis dynamometer (below) to bring you today's top gasolines.



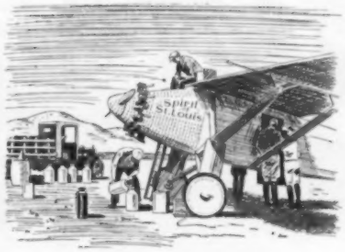
Before horses gave way to horsepower, Standard's wagons of the '80's brought only kerosene, harness oil and axle grease to Western farms. Now our insecticides, weed-killers, fertilizers help increase crop yields and add to your food supply.

First steel tanker in the Pacific, Standard's *SS George Loomis* back in 1888 began helping us put oil where you need it. Today 26 tankers, 3,748 miles of pipe line, thousands of tank trucks serve your oil needs wherever you are in the West, Alaska, Hawaii.

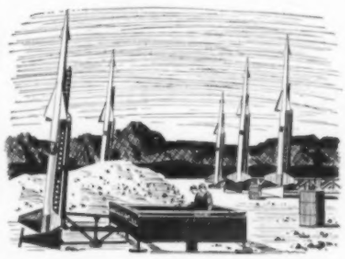


World's first gas station was opened by Standard in 1907 at Seattle, Washington. Since then, we've pioneered the car care you enjoy now—windshield cleaning, tire, battery, lubrication service, even "Chevron-matic" credit cards to save you time.

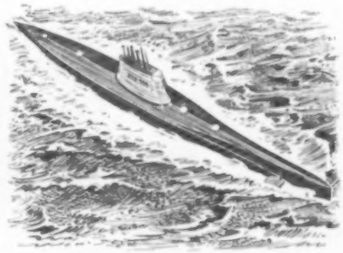
First oil industry 8-hour day was introduced by Standard in 1917. This was a major step in our employee relations programs which include health, pension, insurance benefits and a stock purchase plan—95% of eligible employees own Company stock.



On Lindbergh's trans-Atlantic flight in 1927, we fueled "The Spirit of St. Louis." Now, safer airliners, faster military planes mark aviation progress which Standard's research has served. Now we're making fuels for tomorrow's jets and rockets.

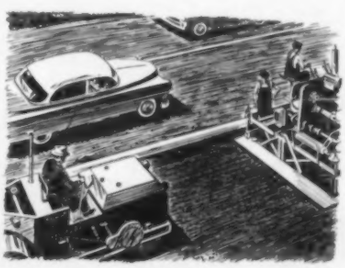


New power for transportation and industry was born in 1935 when Standard's first compounded diesel lubricating oil made high-speed diesel engines a practical reality. Now our scientists are working on lubricants for the first atomic submarine.



Making housework easier, Standard made detergents available for "soapless soaps" in 1946. Later we produced the basic ingredients for wrinkle-proof clothing for men and women, adding again to the more than 1100 products we make from oil.

We pioneered peace-time use of atomic energy. In 1950, using radioactive piston rings, Standard measured engine wear as it occurs, used this research to develop better motor oils, including a new oil so superior it can boost gas mileage up to 15%.



The promise of the past is an even better future

You wear a suit woven from oil, drive on tires born in a refinery, whisk over asphalt super-highways, read about kerosene-powered planes that crack the sound barrier. And you live in a West far beyond the dreams of those 1879'ers who formed the Company from which Standard grew.

What lies ahead? If the past is any clue, oil will be saving you more work and money, improving your transportation and putting more luxury in your living. And Standard will continue to play a big part in this progress as we follow our 75-year tradition of planning ahead to serve you and the nation better.

STANDARD OIL COMPANY OF CALIFORNIA

THE Pyrene TRADE MARK COMPANY LIMITED

....the world's largest manufacturers of Mechanical Foam Fire Fighting Equipment for the protection of the Oil Industry

'Pyrene' Mechanical Foam provides the most highly developed fire protection against all oil and spirit fire dangers in the oil industry. There is no more efficient answer to these formidable fire risks than 'Pyrene' appliances using 'Pyrene' foam-making compound to produce fire-fighting foam of the very highest quality.

The range of 'Pyrene' equipment—evolved after 40 years of research and practical experience—includes Mechanical Foam Generators and Foam-making Branchpipes; Fixed Foam Installations incorporating Foam Inductors or Proportionators; Foam Pourers and Vapour Seal Boxes; Portable Foam Towers; Foam Monitors; and 'Pyrene' Foam Tenders and Trailers, which combine mobility with speed of action and a high foam-producing performance.

Apart from the major equipment outlined above, there is also a wide range of 'Pyrene' fire appliances using every proved fire extinguishing medium, including chemical foam, CO_2, CO_2-dry chemical, soda-acid and special liquids such as 'Pyrene' Fire Extinguisher Liquid, methyl bromide, and chlorobromomethane. These appliances are designed for immediate action against incipient fires of all classes, and thus play an essential part, with the larger equipment, in providing fire protection that is fully comprehensive.

We would welcome the opportunity of offering the impartial advice of our Fire Engineers. This service or free illustrated literature will be supplied on application to dept. W.P. 5.

THE PYRENE COMPANY LTD., 9 Grosvenor Gardens, London, S.W.1.

Cables **"Pyrene - London"**

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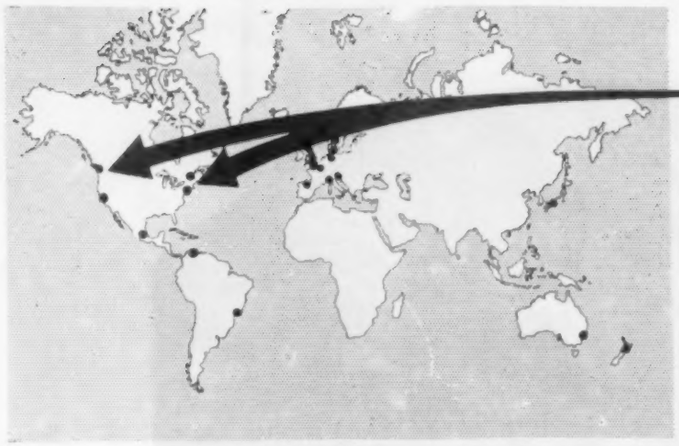

At Montreal and Vancouver, associated "International" factories are producing paints for a variety of purposes. Their on-the-spot technical experience of paints for Canadian requirements is no small contribution to the wealth of knowledge accumulated by the world wide group of International factories.

"International" have associated Companies in 15 other countries and close co-operation ensures the ability to supply the right paint for anything, anywhere. "International" products include METAL PRIMERS and ALUMINUM PAINT for storage tanks; DRUM PAINTS, and ENAMELS for general purposes.

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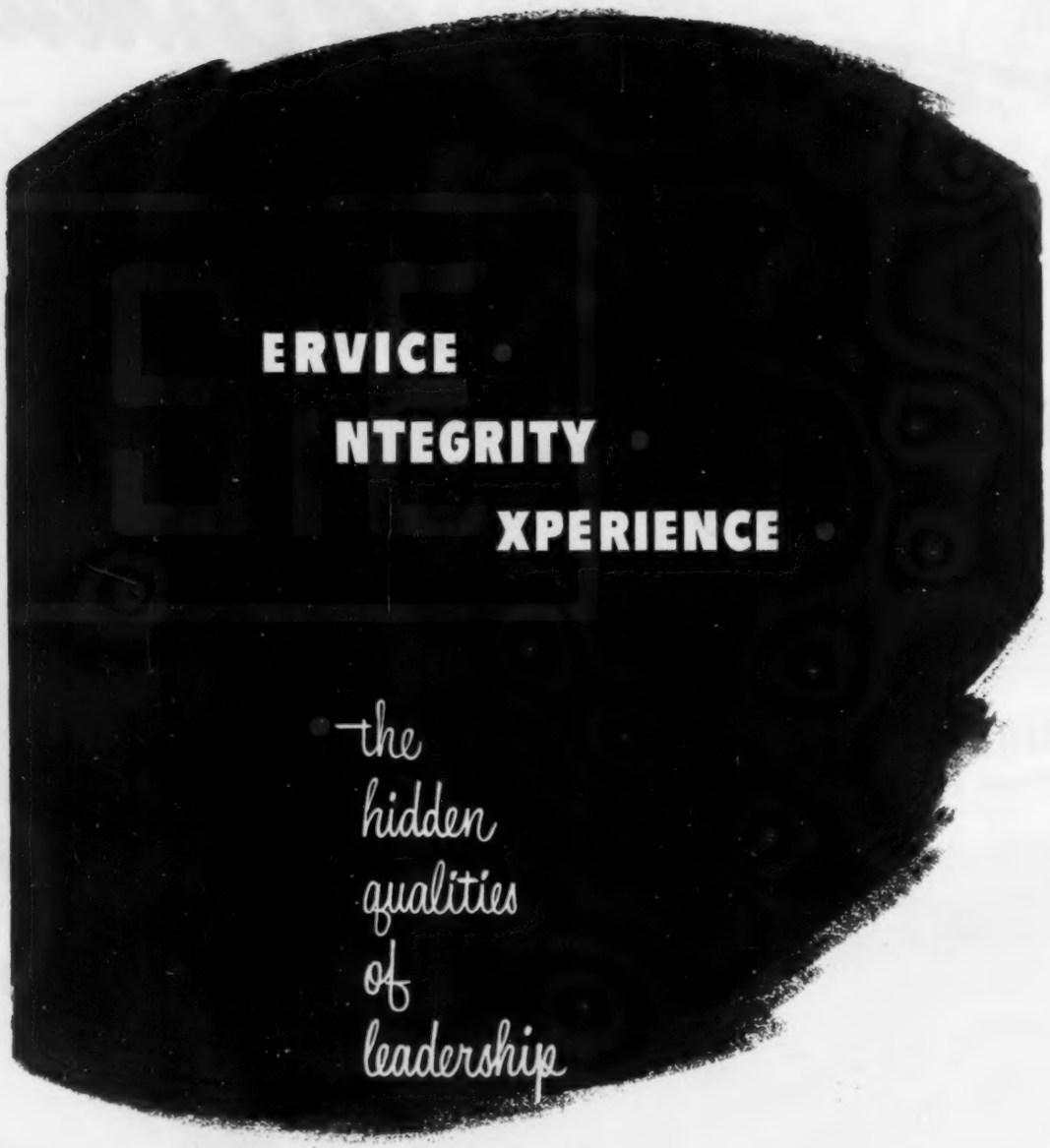

SIE

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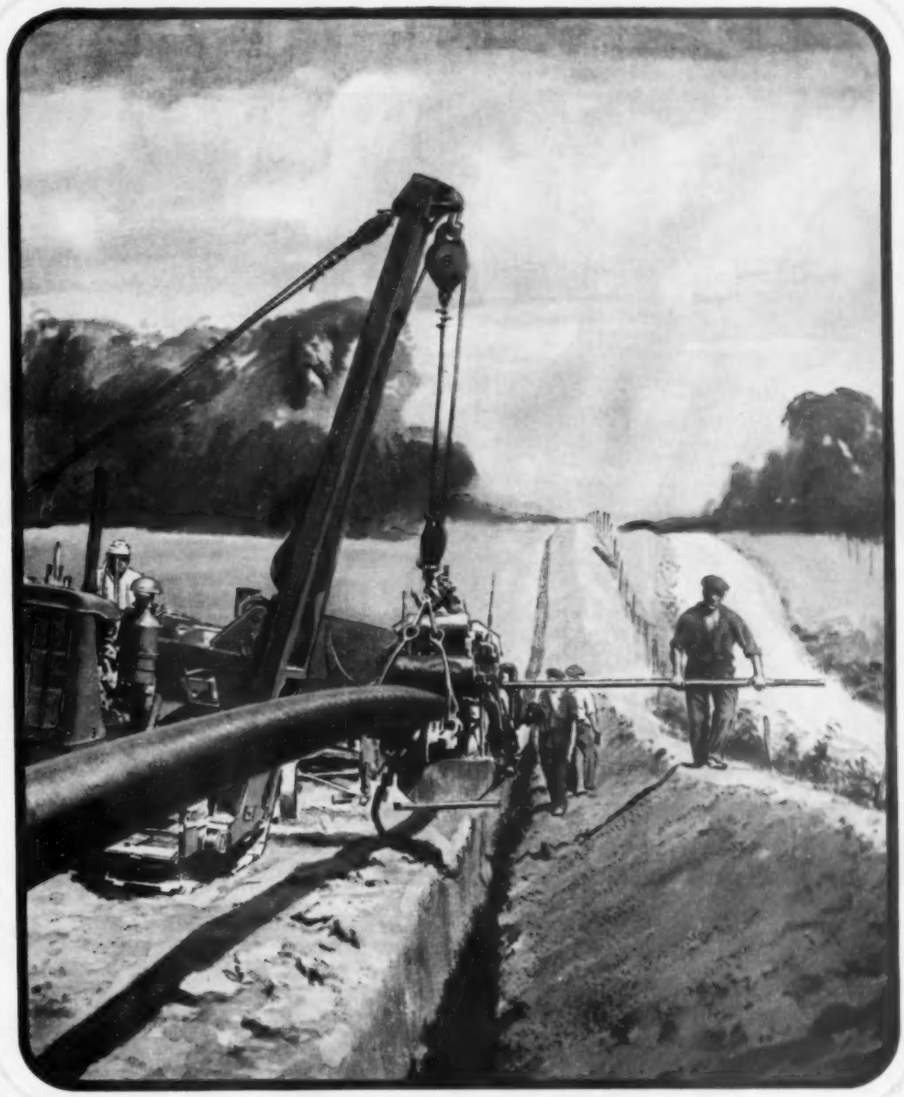

THE STEEL TUBE AGE

Coating and wrapping a section
of the natural-gas pipeline installed by
Northwestern Utilities, Limited, to convey gas
from their Viking-Kinsella field to the
City of Edmonton, Alberta.

STEWARTS AND LLOYDS LIMITED

GLASGOW · BIRMINGHAM · LONDON

The largest manufacturers of steel tubes in Europe

S&L

1954 *the NEW* STEEL BOND

Sixty-nine years ago, completion of the first transcontinental railway brought new prosperity and development for Western Canada.

To-day, a second steel bond between East and West is being forged—the system of oil and natural gas pipelines carrying the West's natural wealth to markets in the central provinces and on the Pacific Coast. The influence of this second "ribbon of steel" on the economy of Western Canada could well be as profound as that of the railway.

So vast and important an undertaking needs the skill and drive of experienced "big inch" men. That's why important stretches of all major lines have been entrusted to Anderson International—the Canadian arm of the largest construction company in the world specializing in pipeline work.

Oil men in both North and South America EXPECT the Anderson organization to solve construction problems that would stop others in their tracks. What's more—they're never disappointed.

R. W. Jernigan

R. W. Jernigan, vice-president of Anderson International Contractors Limited, was in on the first major pipelining job—the "Big and Little Inch," built by the U. S. Government, in 1942 from Texas to the Eastern seaboard.

His company, Anderson Bros. of Houston, Texas, was one of the eleven contractors on the job, and Dick Jernigan was Carl Anderson's right-hand man. During the course of his company's growth into the largest pipeline contractors in the world, Dick has served it in practically every capacity. With the organization of Anderson International in Canada in 1952, he became its vice-president and director.

PIPELINE SPECIALISTS

ANDERSON
International
CONTRACTORS LIMITED

Rawleigh Building Edmonton, Alberta

KNOWLEDGE
a power for good

The Standard-Vacuum organization is continually expanding its educational and training programs for its 40,000 employees in the various areas where it operates.

In Indonesia, for example, 71 formal training courses as well as on-the-job instruction are giving several thousand men new skills . . . teaching them to work as a team and to produce more . . . improving their ability to shoulder responsibility . . . adding to their economic security as individuals and their economic strength as citizens.

Stanvac seeks to do its part in developing the capacities of its employees so that they become better qualified to carry on the company's operations and to participate in supervisory and administrative functions.

Greater knowledge is truly a power for good.

STANDARD-VACUUM OIL COMPANY

A name that stands for "Progress" in the East

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DRUM OUTPUT REVOLUTIONISED

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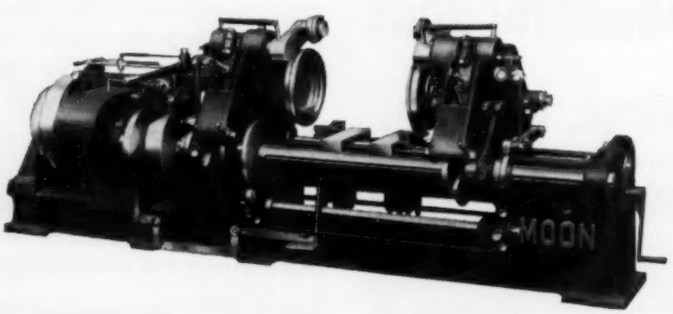
If your requirements are unusual, equipment can be designed to meet them. Such specialised designs will, naturally, embody the MOON principles of speed, quality and economy.



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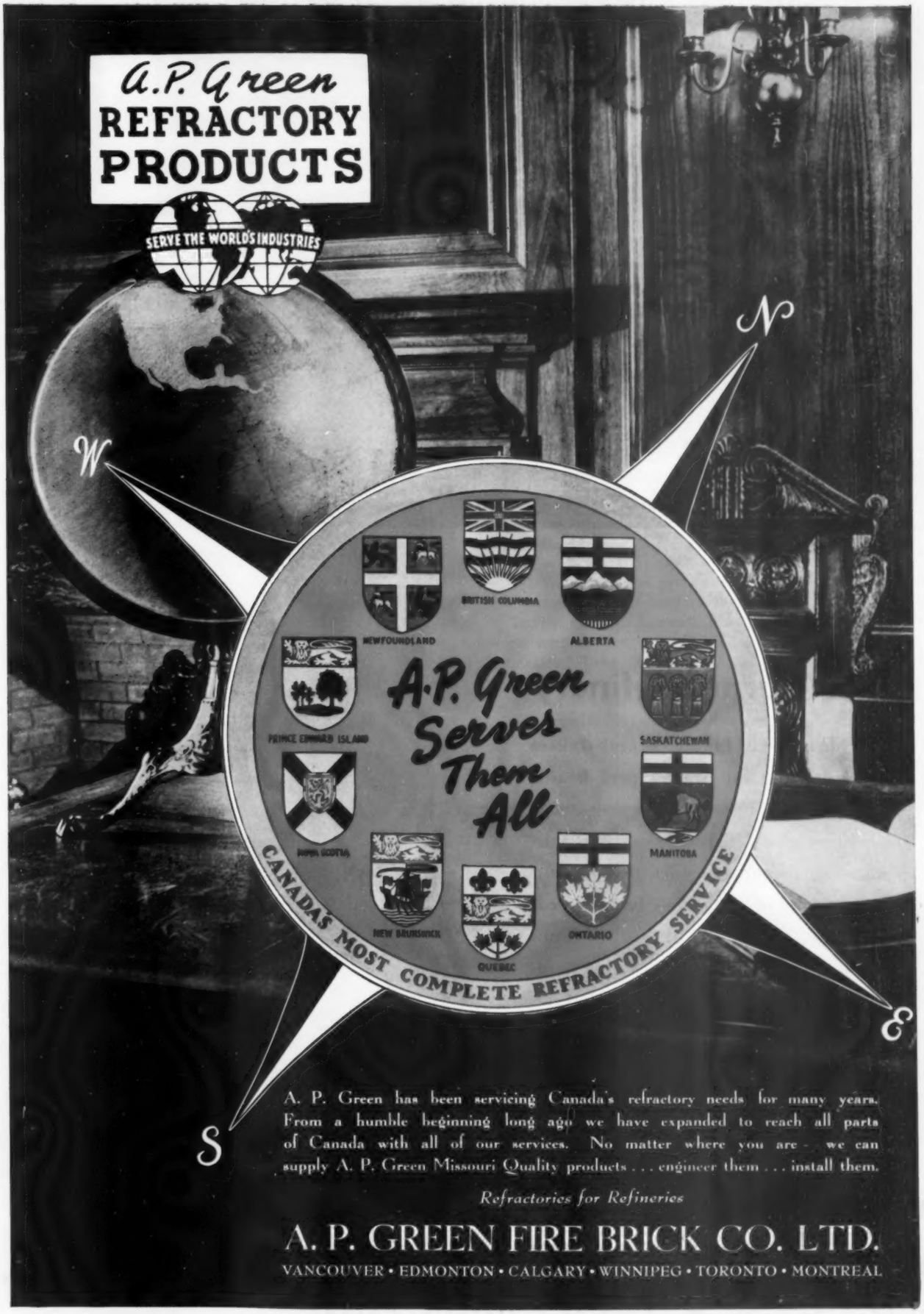
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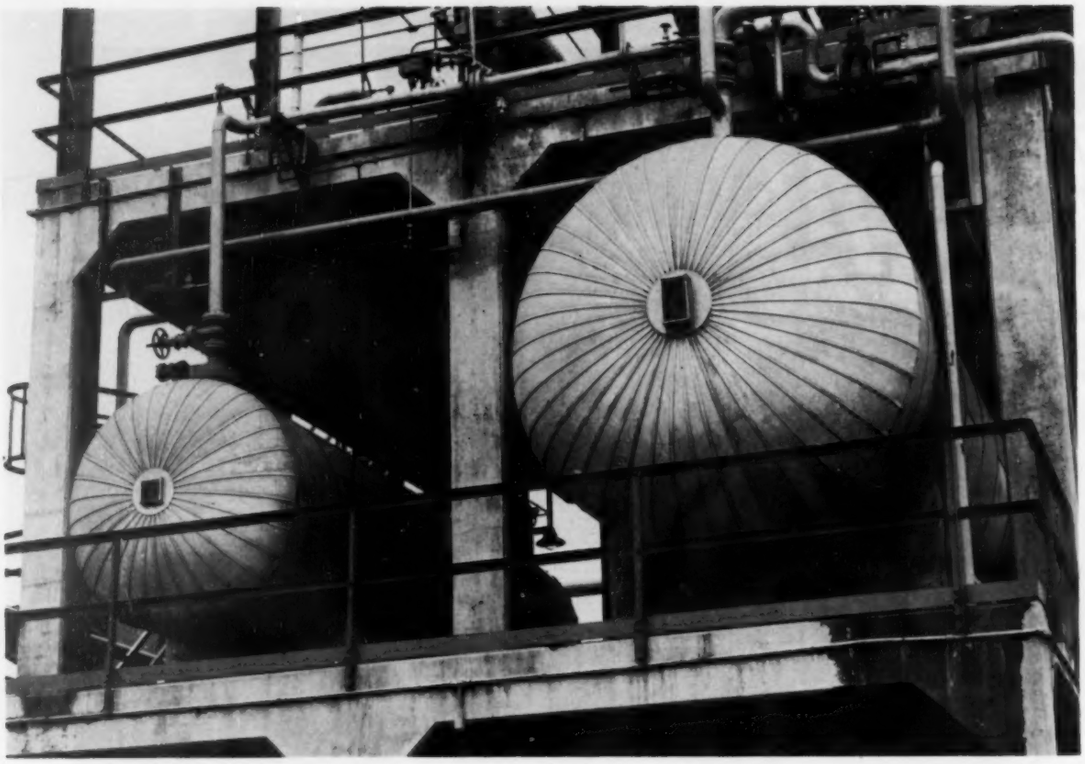
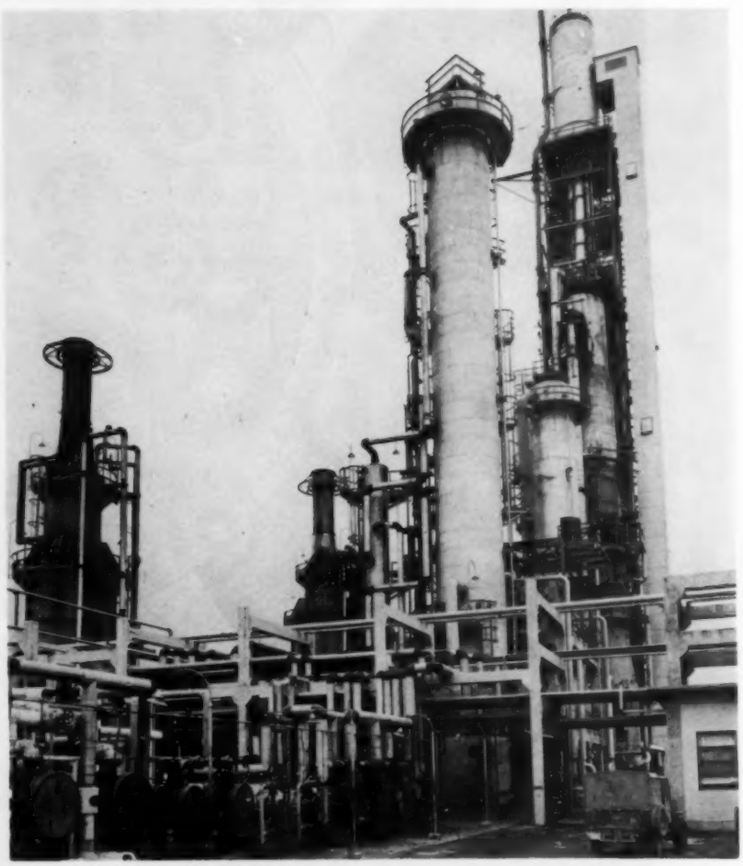


Orange peel sheet metal heads and tank covering supplied by Giffin for Sun's Sarnia refinery.

Giffin also supplied sheet metal for towers and pipe lines at Sarnia.



at Sun's Sarnia refinery

Giffin Sheet Metals Limited supplied sheet metal covering on orange peel heads, body of tanks, vessels, exchangers, and pipe lines, all ventilation work and miscellaneous sheet-metal work throughout. We are proud of the part we have played, together with the staffs of Sun Oil Company and the Catalytic Construction Company of Canada, in making this latest addition of completely new facilities to Canada's rapidly expanding petroleum industry.

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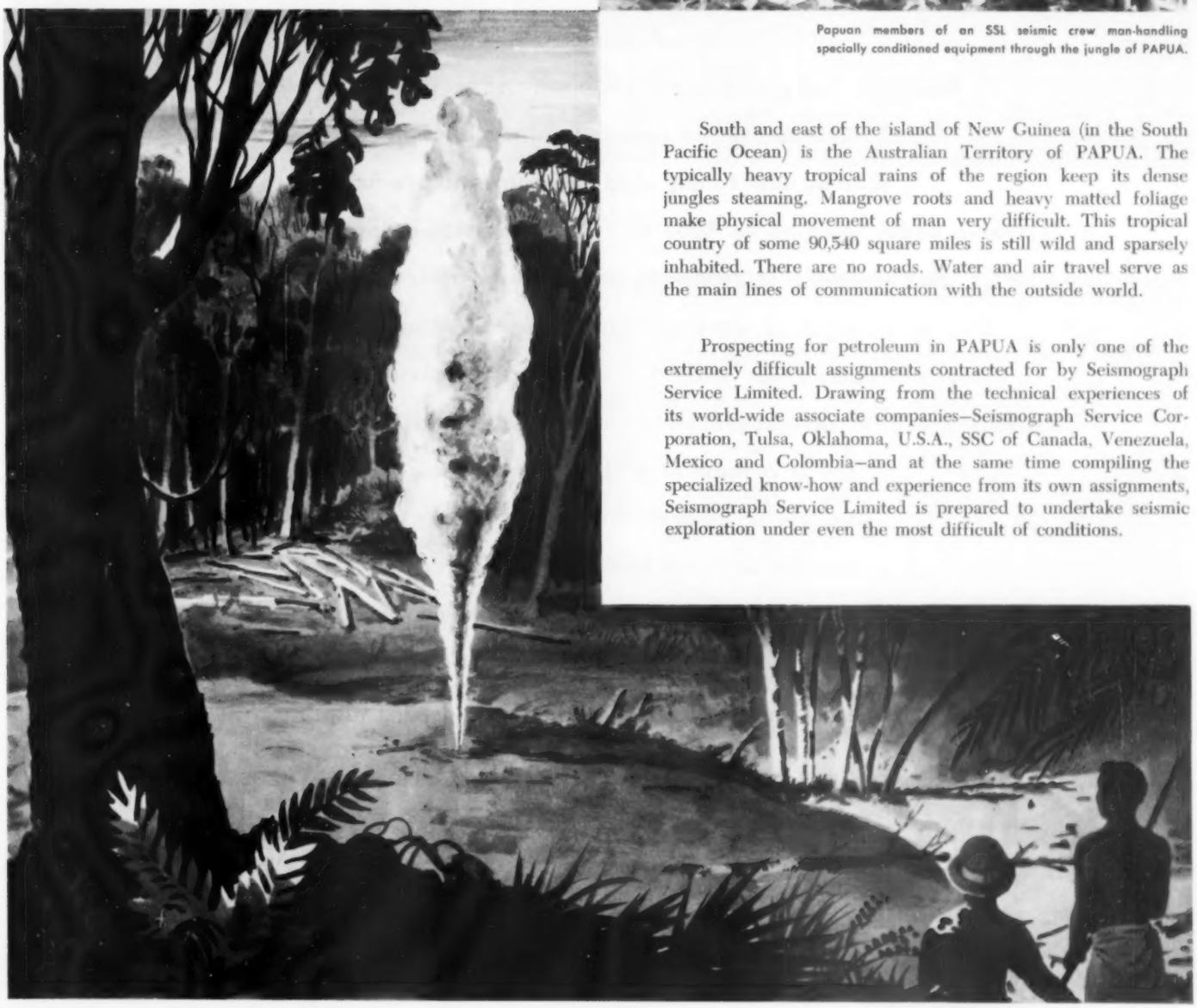
General Sheet Metal Contractors and Specialists to the Refining Industry

64 Golden Avenue, Toronto 3, Ontario, Canada

OIL
MUST BE DISCOVERED

Papuan members of an SSL seismic crew man-handling specially conditioned equipment through the jungle of PAPUA.



South and east of the island of New Guinea (in the South Pacific Ocean) is the Australian Territory of PAPUA. The typically heavy tropical rains of the region keep its dense jungles steaming. Mangrove roots and heavy matted foliage make physical movement of man very difficult. This tropical country of some 90,540 square miles is still wild and sparsely inhabited. There are no roads. Water and air travel serve as the main lines of communication with the outside world.

Prospecting for petroleum in PAPUA is only one of the extremely difficult assignments contracted for by Seismograph Service Limited. Drawing from the technical experiences of its world-wide associate companies—Seismograph Service Corporation, Tulsa, Oklahoma, U.S.A., SSC of Canada, Venezuela, Mexico and Colombia—and at the same time compiling the specialized know-how and experience from its own assignments, Seismograph Service Limited is prepared to undertake seismic exploration under even the most difficult of conditions.

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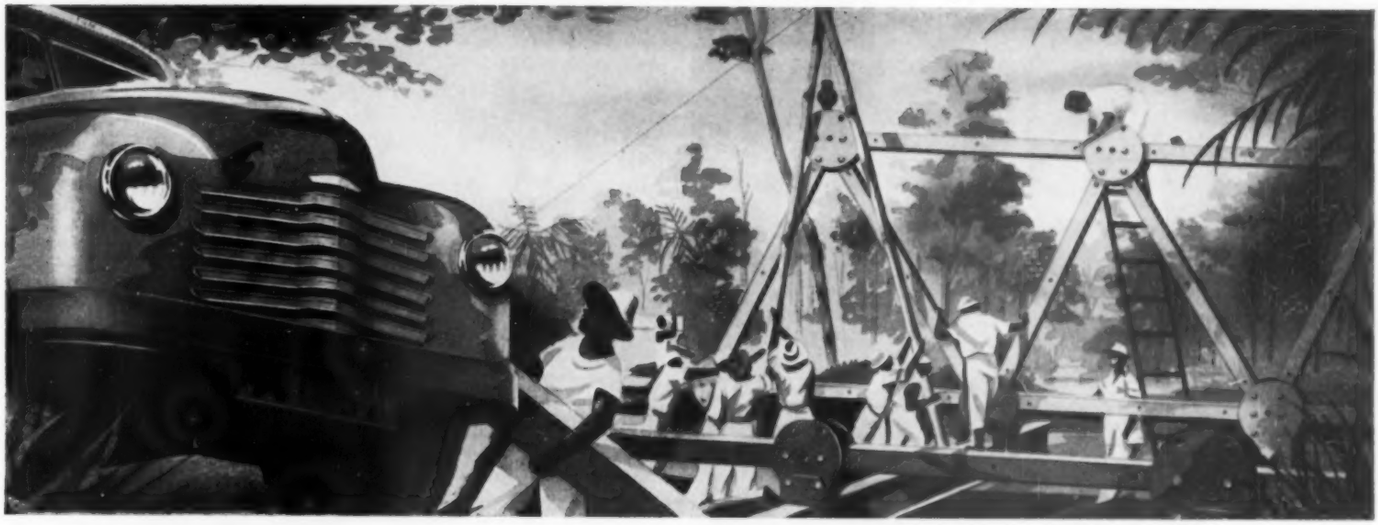

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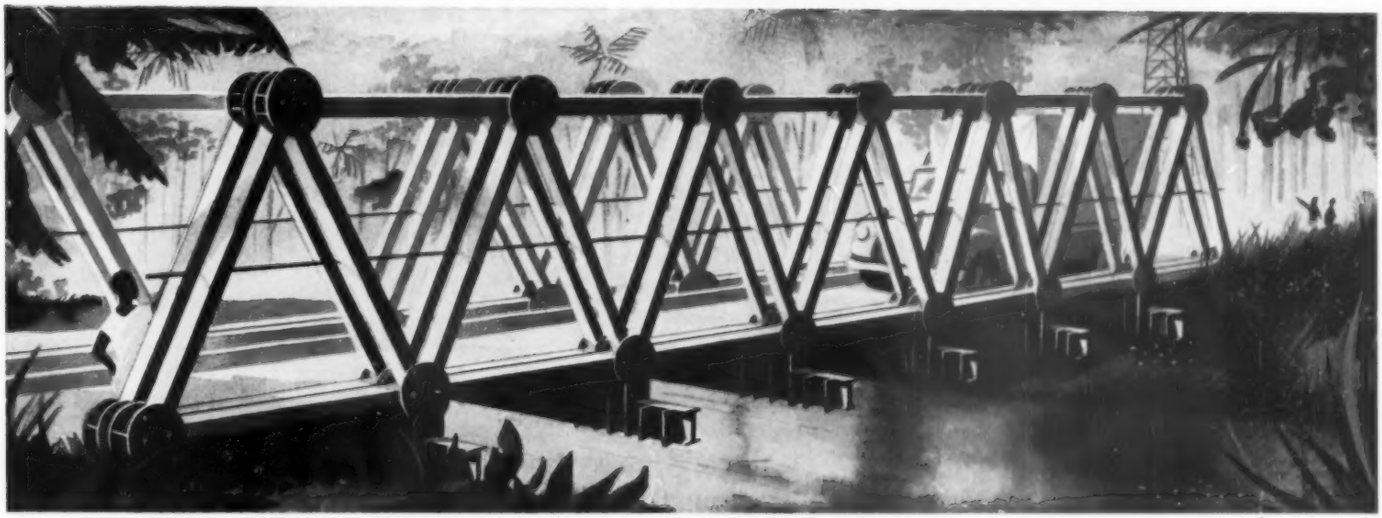

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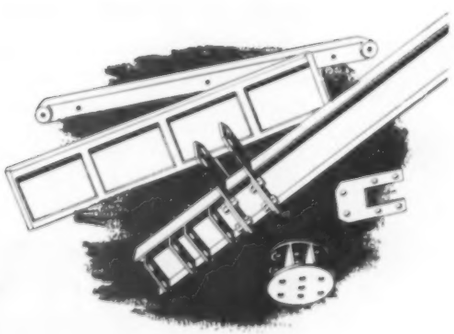

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INDIA—During the Indian Railways Centenary Exhibition in 1953, visitors to the Caltex stall were impressed with exhibits and literature showing 100 years of railroad development in India. Today, Caltex railroad lubricants and fuels play an important part in maintaining better freight and passenger service . . . assure dependable operation, lower maintenance costs.

EGYPT—Transportation facilities in the principal cities of the "Land of the Pharaohs" are strictly up to date. To motorists and fleet owners, modern Caltex service stations—like this one in Cairo—offer the latest in automotive products . . . and the efficient service that brings back old customers and attracts a constant flow of new friends.

Caltex serves the people of 67 lands

In 67 lands, across half the world, through such developments as these, Caltex is able to supply better fuels and lubricants for industry, for agriculture, and for motoring millions. These require a continual investment of funds and skills, backed by a faith in a better future for free nations.

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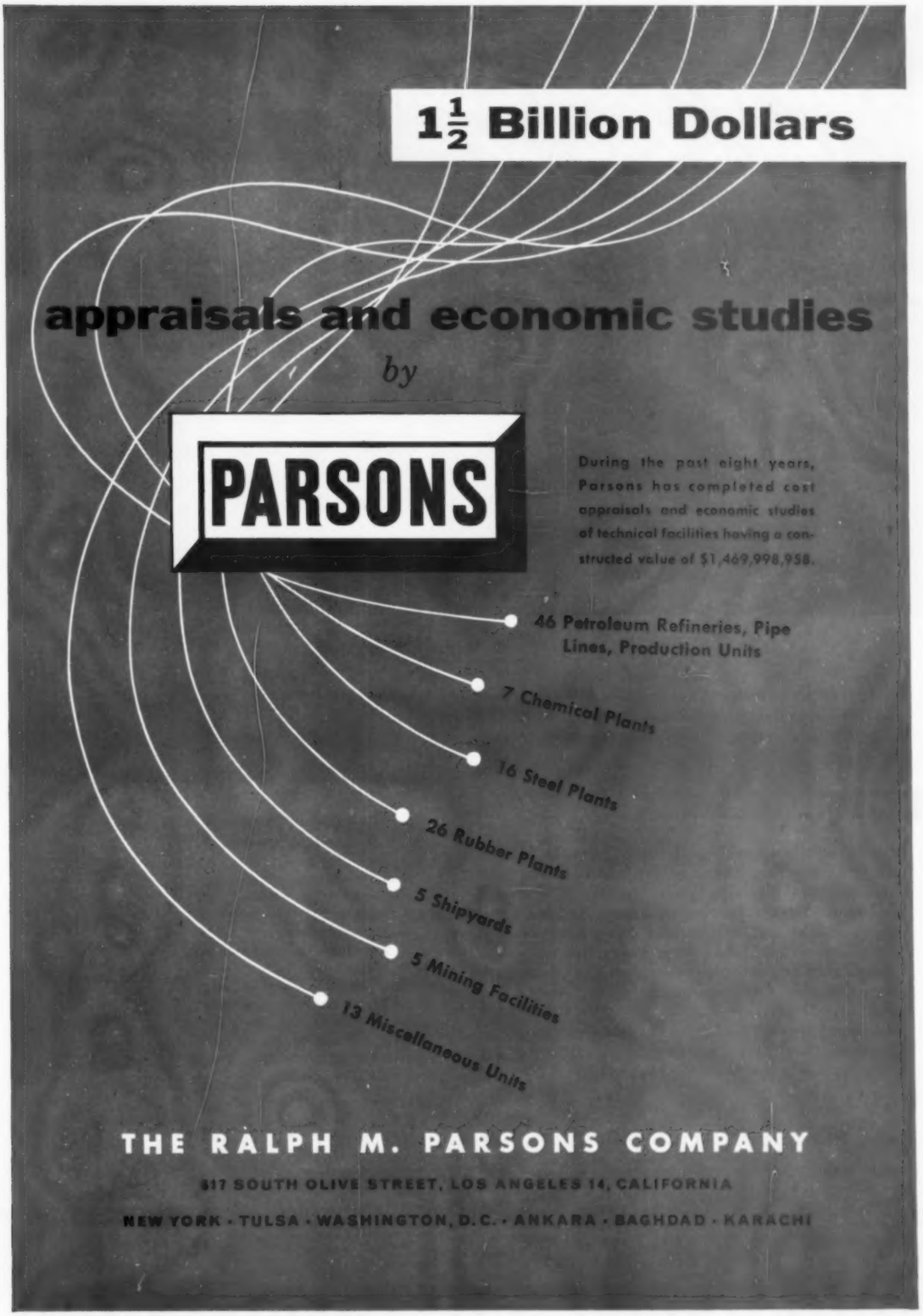
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SUITABILITY:	Fully effective
FEATURES:	Crane Exelloy Trim
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SERVICE LIFE:	10 yr. plus—prolonged life assured
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THE CASE HISTORY

Installed as original equipment, these Crane No. 33X 10-inch gate valves have given continuous service since 1943. Year after year, they remain fully effective under severe conditions. They seat tightly with smooth, positive operation, yet with no maintenance other than periodic cleanout of accumulated oil sludge. Their Crane Exelloy seating surfaces show no sign of corrosive or erosive effects. They assure the plant of continued trouble-free, low-cost performance.

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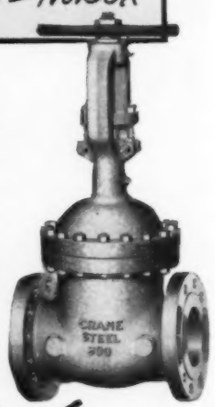

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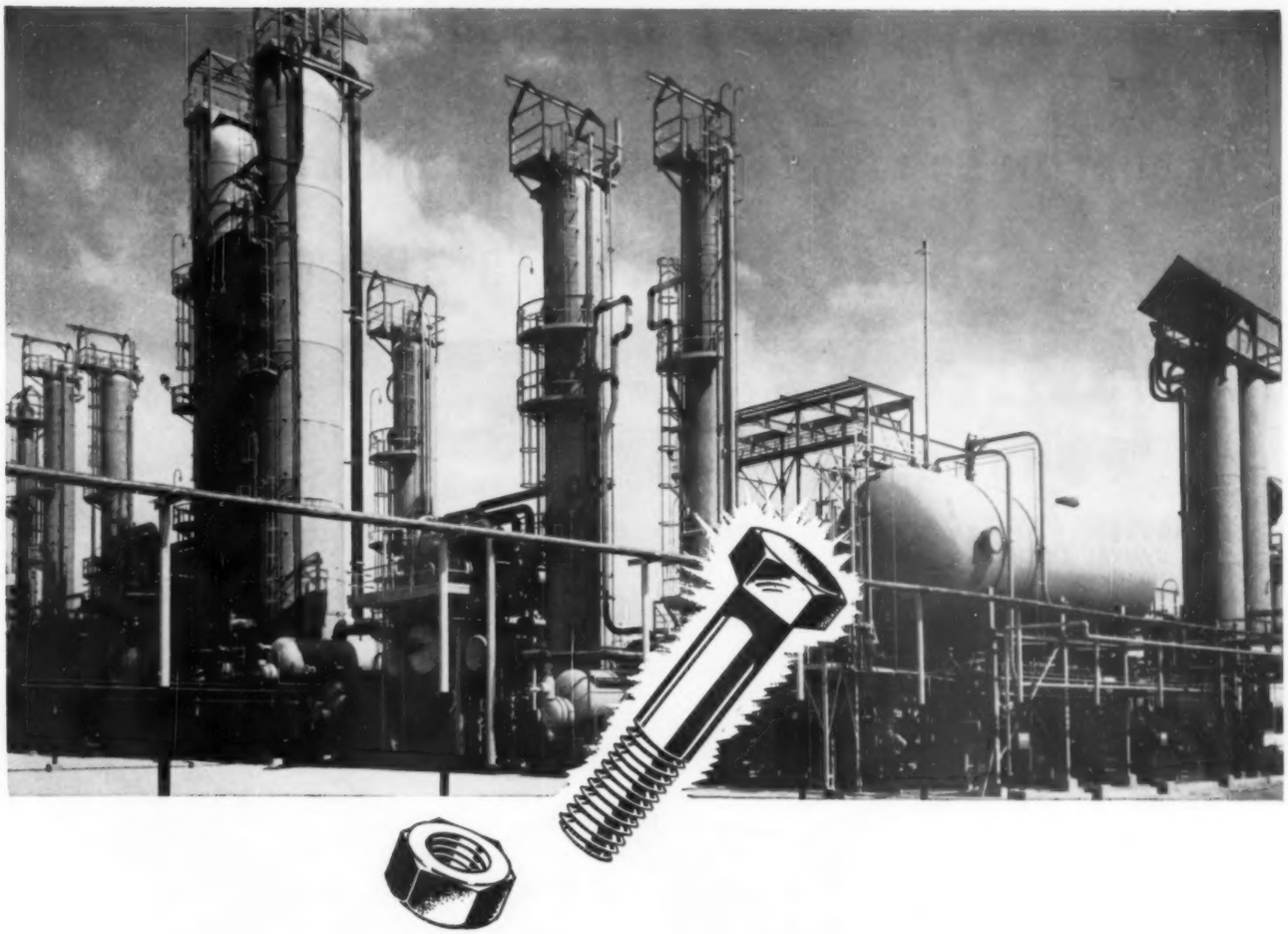

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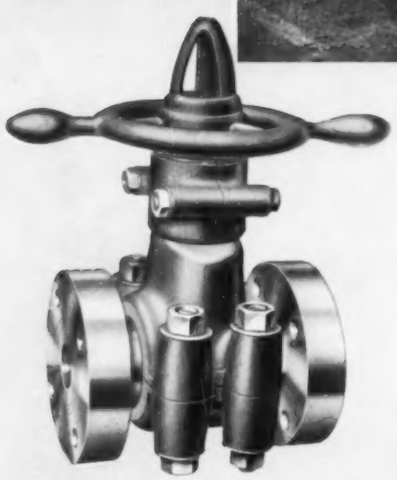

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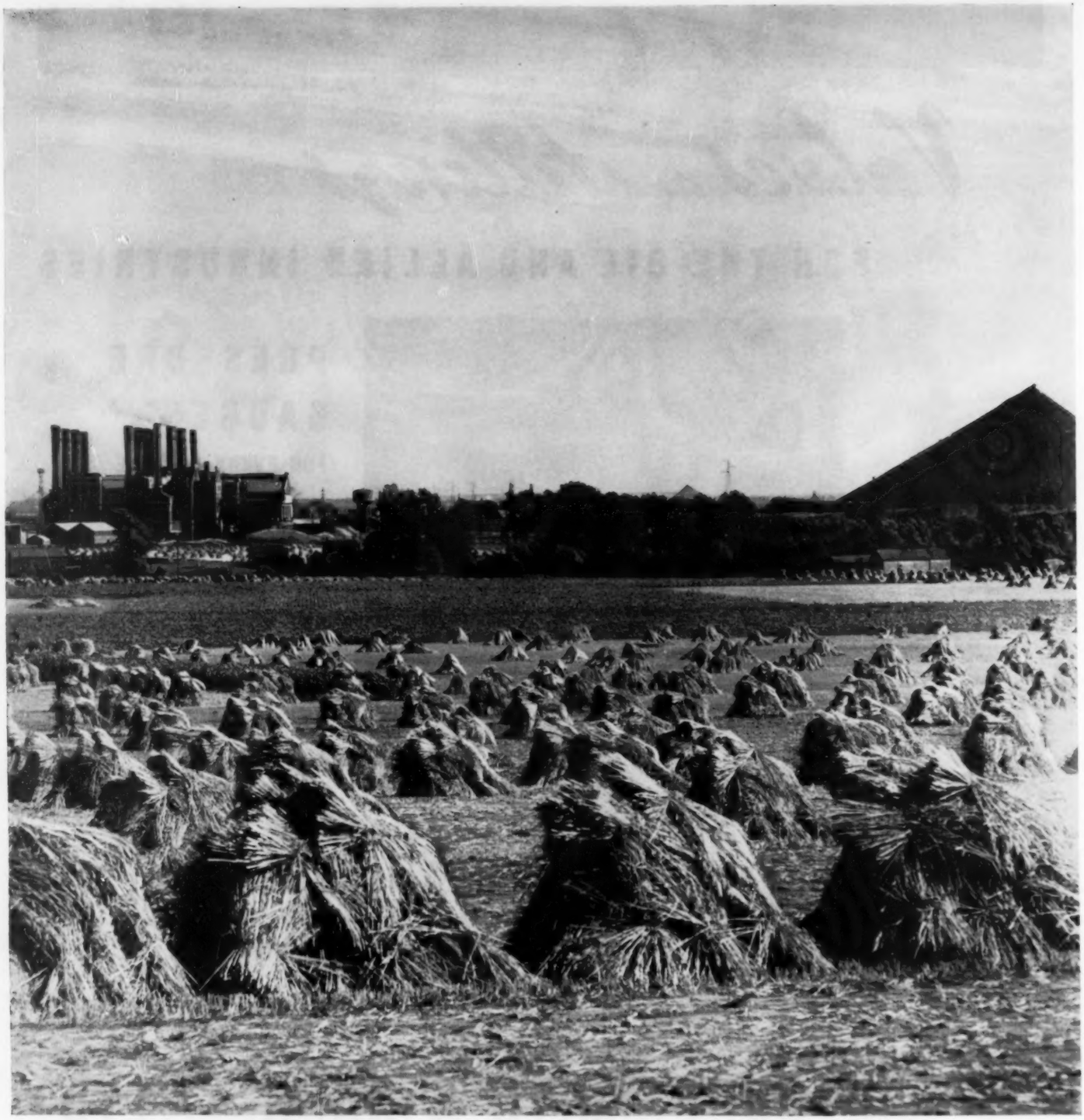

"In this age, all nations look to industrial development as an important means to national strength and better living standards for their peoples. But important as it is, industrial development must not be allowed to get out of balance with agriculture and other elements of the economy. Pushing industrial development at too fast a pace can disrupt agriculture and foreign trade dependent on it."

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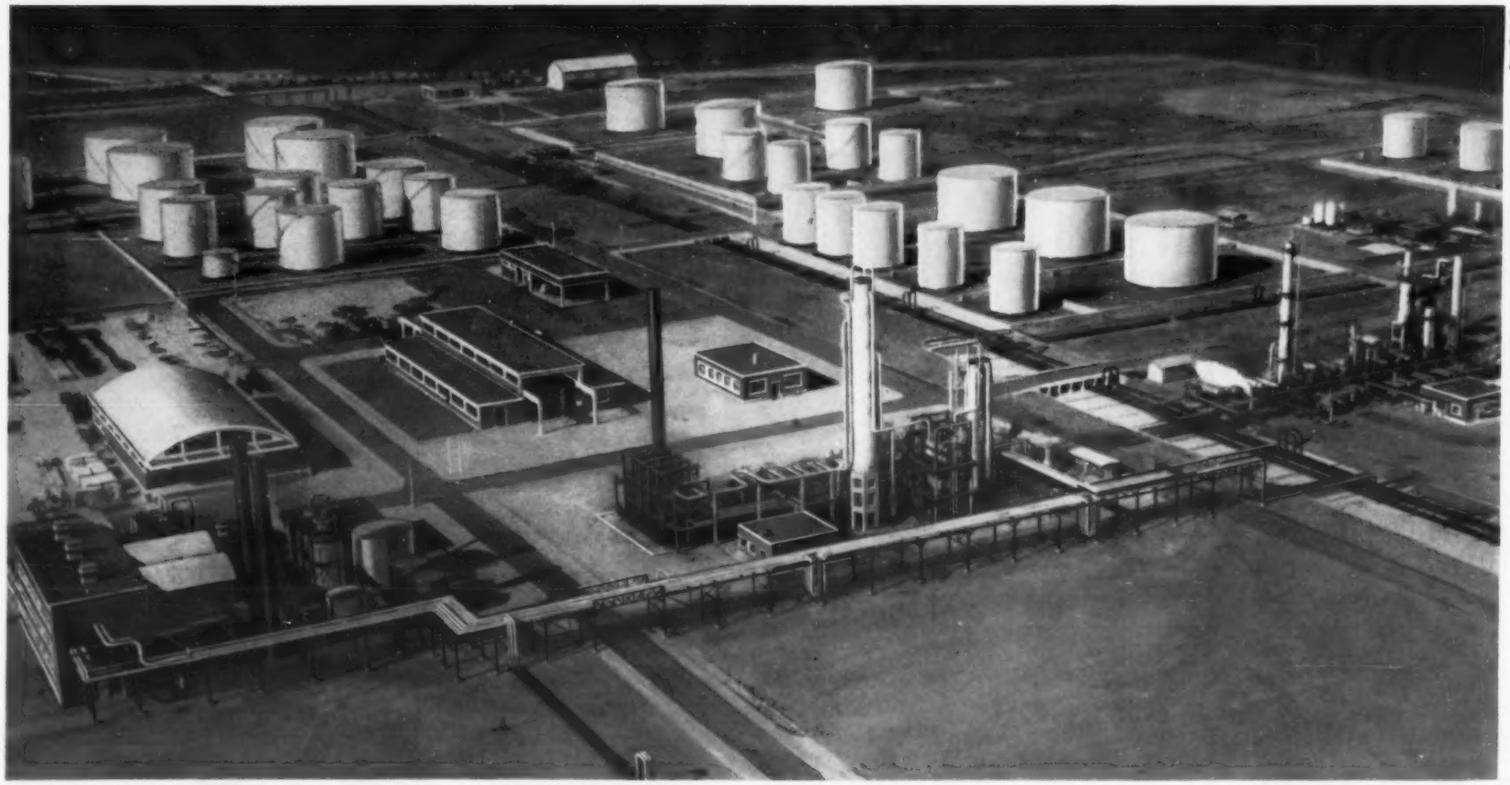
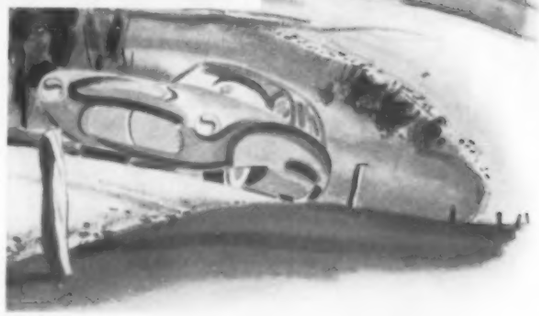
STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES



Crude oil is piped to the Sarpom Refinery at San Martino di Trecate, Italy, from Savona on the Mediterranean.



ITALY'S NEW LOOK

The basic design of the "Sarpom" refinery, recently completed on the plains of Northern Italy, is the work of Stone & Webster Engineering Corporation, with detailed engineering, procurement and construction management by its affiliate, E. B. Badger & Sons Limited.

The refinery, having a capacity of 15,000 barrels per day, consists of crude distillation, reforming, treating and general facilities. Catalytic cracking and polymerization units are now being added.

These facilities for Societa per Azioni Raffineria Padana Olii Minerali, a Caltex-Fiat subsidiary, are among eighty new refinery units recently executed by our Badger Process Division.

Write or call us for information as to how our experience may be of assistance to you.

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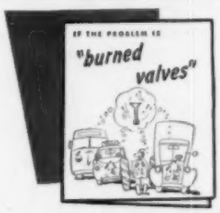
DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

May ★ One of a Series of Interest to the Petroleum Industry ★ 1954



Burned valves are rarely the fault of the fuel or oil

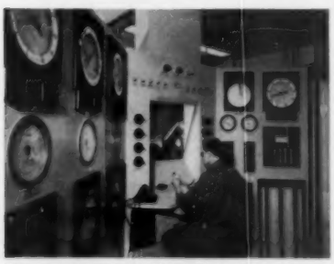
Yet, your fleet and farm account salesmen often have to take the brunt of valve-burning complaints. Now, the 4-page, pocket-size folder shown above can help you and your representatives get off the hook on these complaints.

Graphically illustrated by cartoon drawings, this folder explains why most valve troubles are the result of improper engine maintenance and operation. It discusses carburetor mixture settings, cooling system troubles, valve seating and other factors contributing to valve burning. Involved technical discussions are avoided. The copy is clear, simple and easy to remember.

For sample copies and information on how to obtain "burned valves" folders for your salesmen, ask a Du Pont representative or write to any Du Pont Petroleum Chemicals Division regional office.

Jet Fuel Research Program Initiated At Petroleum Laboratory

As the jet age advances at a fast pace, refiners are being confronted with new problems involving the combustion characteristics of jet fuels.



Operator at the control panel of the "Jet Room" in the Du Pont Petroleum Laboratory.

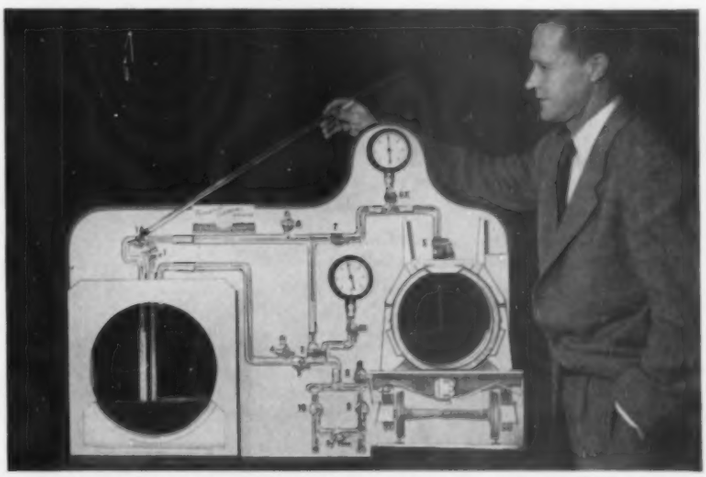
To help in the solution of these problems, the Du Pont Petroleum Laboratory has added new facilities for jet fuel research. These are currently being employed to study the effects of various additives for improving the performance of jet fuels. The present investigations are concentrated on three of the most pressing problems . . . (1) carbon deposition, (2) nozzle clogging, and (3) smoke.

This work on jet fuel additives is part of an extensive research program at the Petroleum Laboratory and other associated Du Pont laboratories.

Du Pont Develops Syphon Starter To Overcome Tetraethyl Lead Tank Car Unloading Problems

Syphon breaks caused by leaks in the vacuum system used for unloading TEL tank cars pose troublesome unloading problems. The development four years ago of the Du Pont Metal-Flex unloading hose has helped to overcome most of the difficulties where smaller weigh tanks are used.

However, the current use of larger weigh tanks and gasoline of higher Reid Vapor Pressure has, in many cases, made it difficult and often impossible to create enough vacuum to unload the bottom portion of the tank car directly into the weigh tank. This difficulty generally results in considerable loss of time and efficiency.



Tank car unloading operations are exactly simulated by this scale model. The weigh tank is on the left and the tank car on the right. Mercury is used in the model to simulate tetraethyl lead compound.

But it is now possible to solve this unloading problem quickly and easily with the aid of a specially-designed "syphon starter."

Developed by Du Pont

Du Pont engineers and technical representatives were frequently called upon for help in solving unloading difficulties at customer plants. Determined to lick the problem, one of these men went to work and came up with the solution.

As a result, a new Du Pont-designed standpipe that acts as a syphon starter was developed.

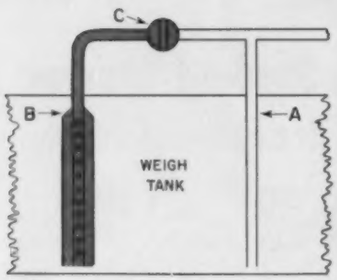
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED

Syphon Starter



This diagram explains the basic principles in the Du Pont syphon starter system. "A" represents the standard standpipe. "B" indicates the perforated standpipe and shield. "C" is the syphon starter valve.

Getting the last drop

Suppose you have a weigh tank which you would like to fill to capacity. You can unload one tank car of TEL compound into it quite readily. But by the time you work down to the "heel" of the second carload, your troubles begin. Only too frequently that last 1,000 lbs. or so of TEL compound just won't syphon out of the tank car.

What has happened? For some reason or other, your syphon has broken. This is most likely caused by air getting into the system from a packing gland leak around a valve or a vortex forming in the compound at the bottom of the tank car.

When the syphon breaks at this point, it is generally difficult and often practically impossible to re-establish it.

What can you do?

In the past, any one of several alternatives has had to be employed to finish the unloading operation. One is by priming the line. You re-establish the syphon by bleeding in gasoline from the circulating system. The disadvantage of this method is, of course, that the TEL compound is diluted and your blending formula upset.

Sometimes it is possible to prime the line by an elaborate manipulation of valves which alternately connect the tank car to the eductor and then to the weigh tank. This method usually requires several operators and may put compound directly into the gasoline instead of the weigh tank.

On the other hand, you might choose to take the TEL directly from the tank car into your circulating gasoline system. But here again your blending calculations are upset and have to be refigured.

Another alternative would be to transfer some of the TEL compound out of the weigh tank and into some other storage tank.

But all of these methods result in a waste of man hours and a loss in refinery efficiency.

The Starter

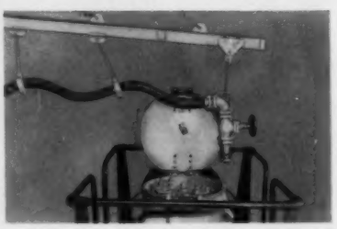
Now, whenever your syphon breaks at a point where it is difficult to get started again, the Du Pont syphon starter comes to your rescue.

The starter itself is an auxiliary standpipe. But it differs from the standard standpipe in that it is perforated. This means that it takes full advantage of the vacuum above the liquid level.

But being perforated, the standpipe has to be designed to prevent the build-up of a static charge which could be explosively dangerous since there is a chance that a gasoline and air mixture may be present in the tank. To guard against this danger, the perforated pipe is surrounded by an outer shield of tubing. The two units are welded together with a series of bracer members.

Because of its potential for increasing unloading efficiency, you will want to know more about the new Du Pont-designed syphon starter. We suggest you discuss it with a Petroleum Chemicals representative, or address your request for further details to the regional office of the Petroleum Chemicals Division in your area.

Metal-Flex Unloading Hose Another Du Pont Contribution To The Eductor System



In TEL tank car unloading operations, leaks—although they may allow only a small amount of air to enter the vacuum system—are the most common cause of syphon breaks.

It was to help prevent these leaks—as well as to add convenience to unloading operations — that Du Pont developed the Metal-Flex unloading hose several years ago. Because of its easy flexibility, it eliminates the binding which tends to cause gland leaks on rigid lines. This also eliminates the need for many costly, hazardous gland repacking jobs.

In fact, hardly any maintenance is required to keep the hose in working condition. This, added to the fact that only one man is required to connect and operate it, means that the Metal-Flex installation more than pays for itself in added efficiency within a very short time.

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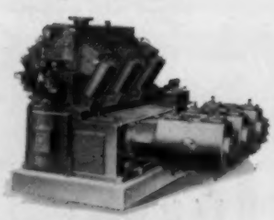

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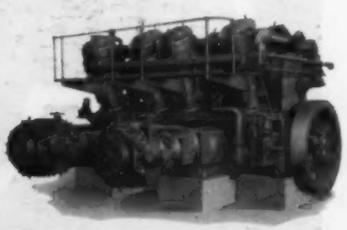

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Ingersoll-Rand companion 4-cycle gas engines are available to drive generators, pumps and other equipment.

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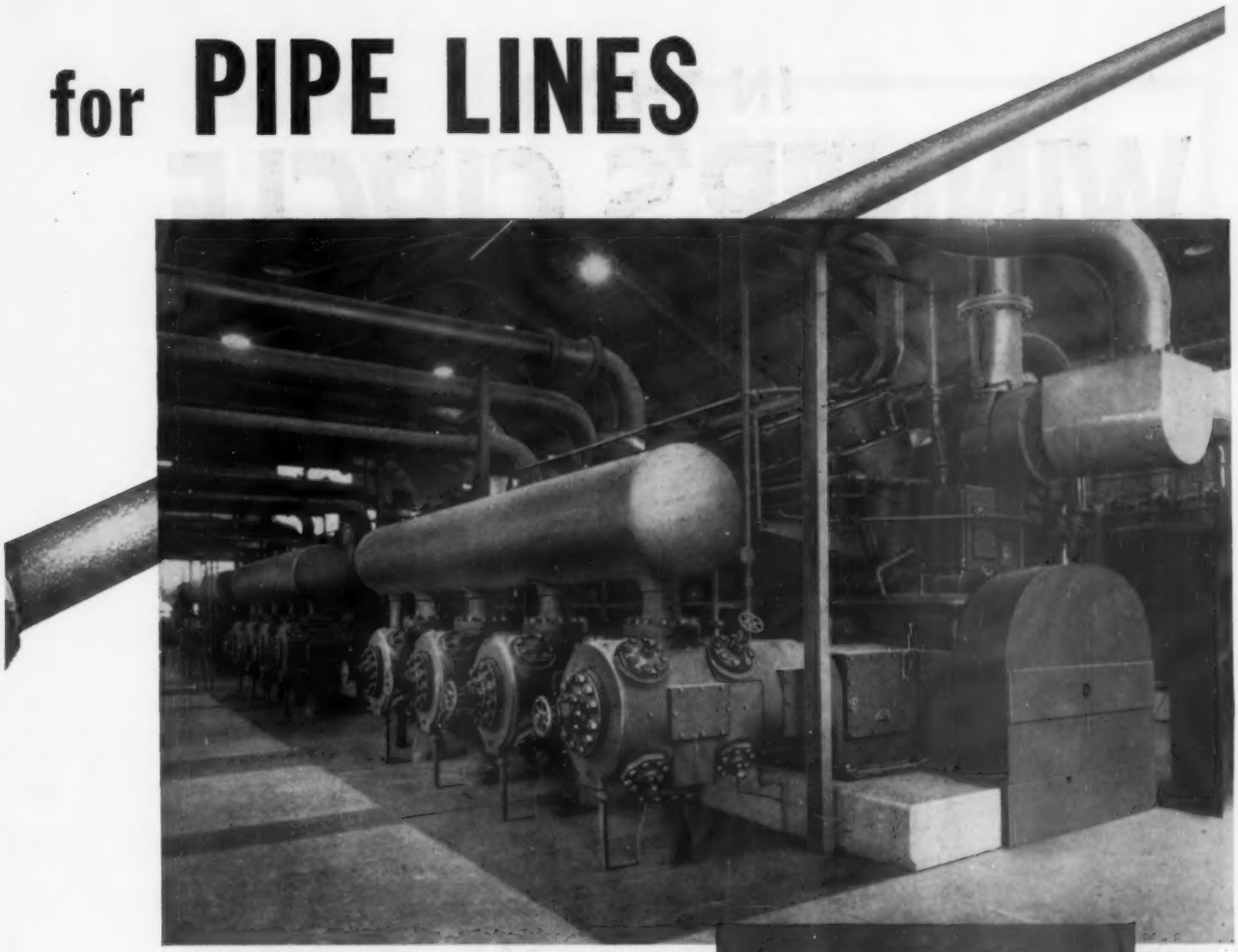

Seven Ingersoll-Rand 2000-hp KVS gas-engine-driven compressors at a natural gas pipe-line station in the Southwest—one of the first large-scale installations of the new Turbocharged unit.

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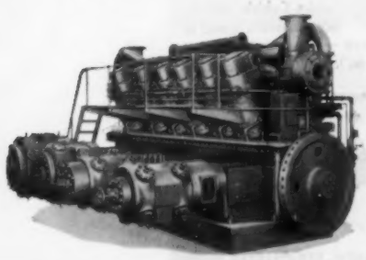
Application



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6-75

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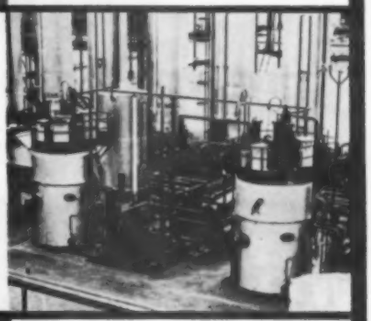

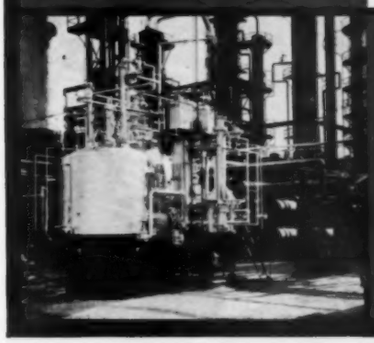

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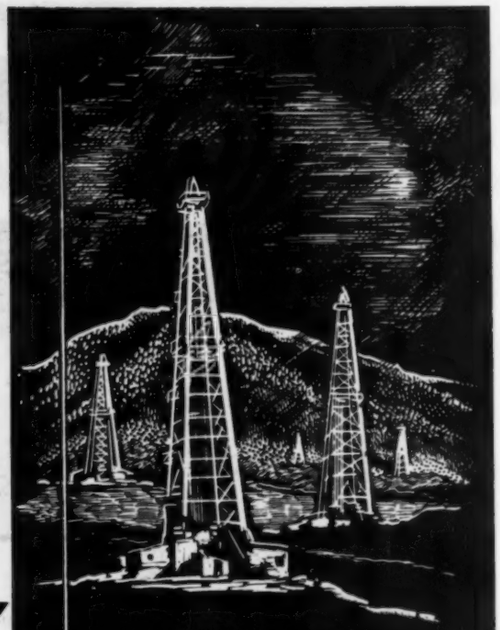

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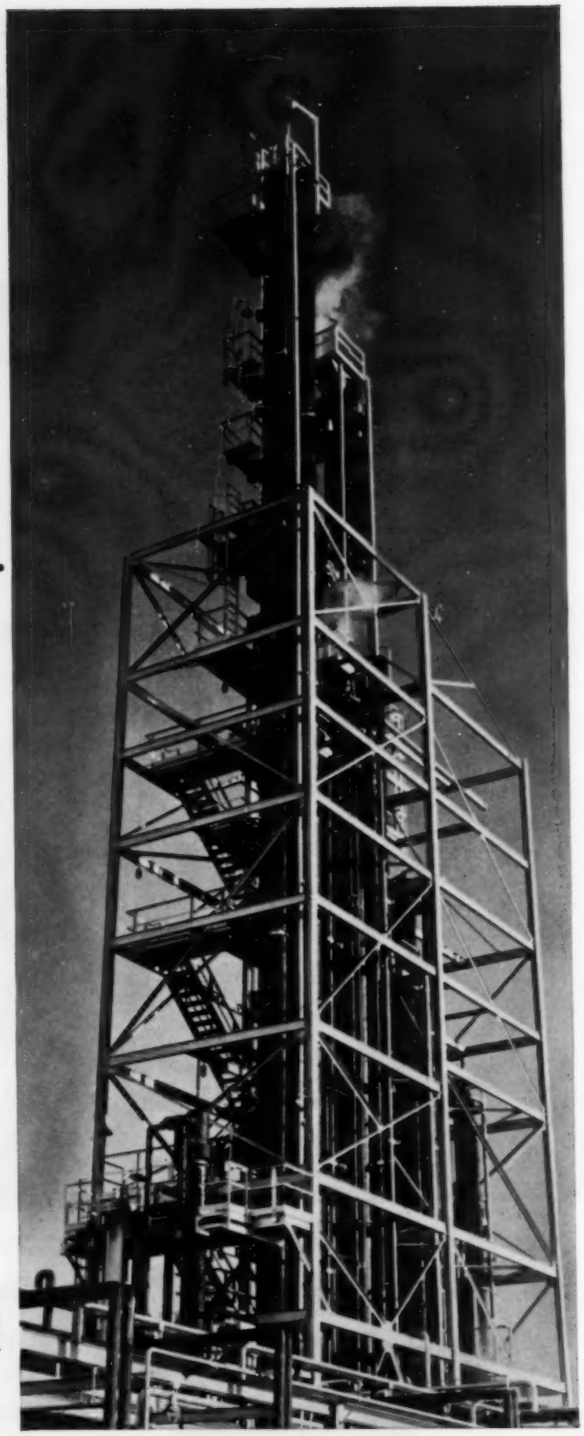

Here, silhouetted against the sky, are giant distillation and absorber towers in the new Canadian Industries Limited Plant at Edmonton, Alberta. Since late last year this plant has been producing highest purity ethylene from natural gas for use in the manufacture of polyethylene.

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Write for Bulletin on the GSI Log Level Indicator and its applications

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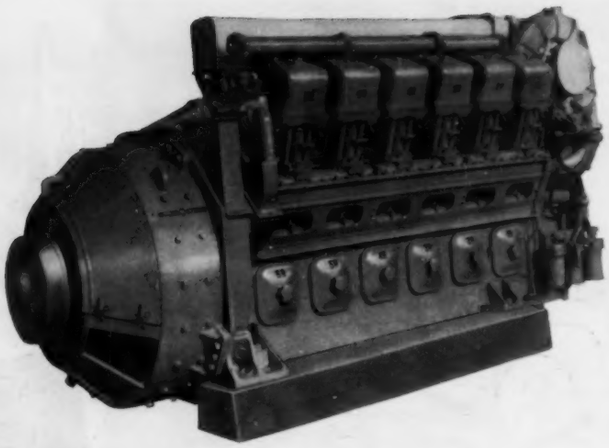

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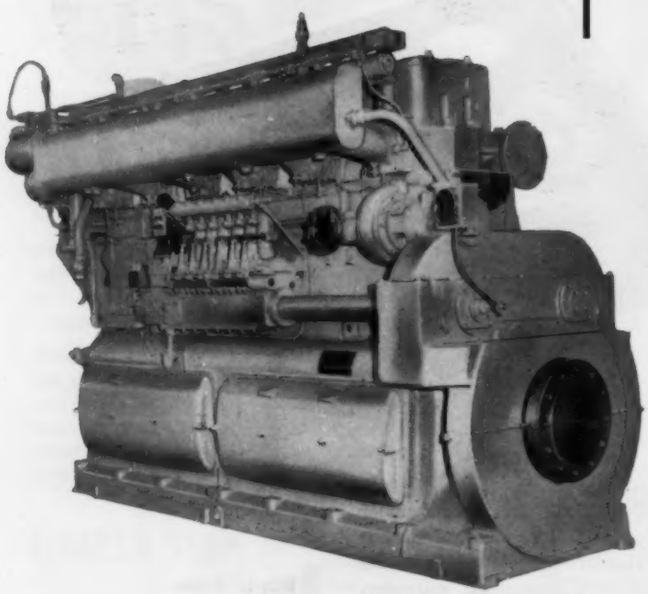

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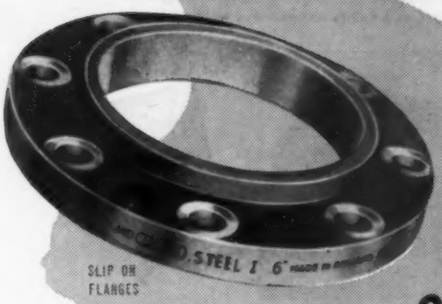

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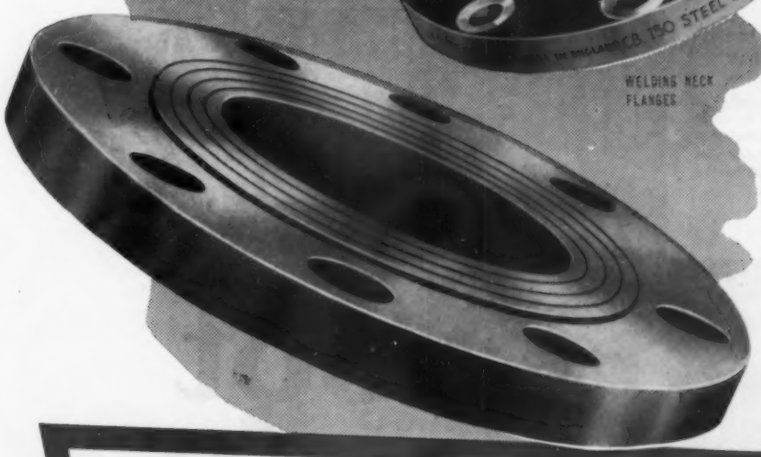

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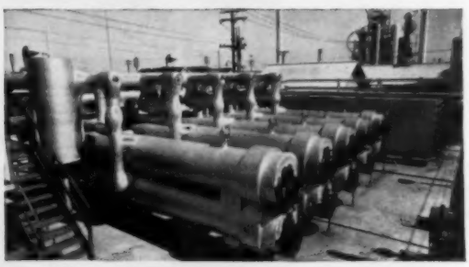

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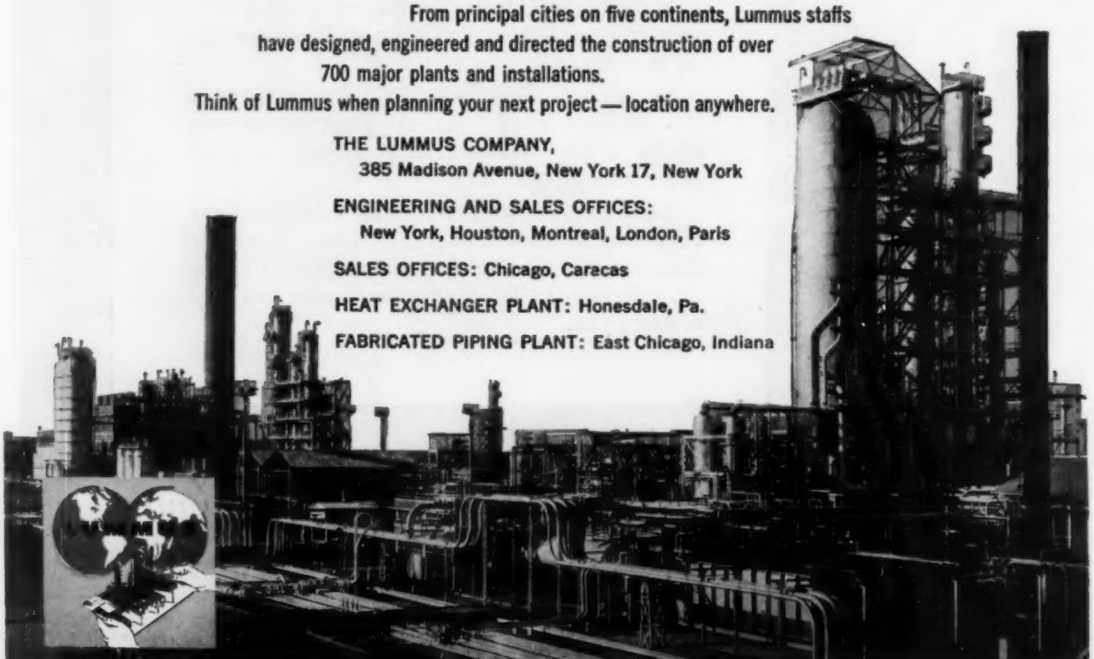

ILLUSTRATED: 40,000 B/D petroleum refinery at Dunkirk, France, designed, engineered and constructed by Lummus for the Société Générale des Huiles de Petrol

VOL. 25, NO. 5, MAY 1954

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer.

CONTENTS

87 A Bright Future, by Ernest C. Manning

88 Western Canada Today, by R. H. C. Harrison

90 Trans-Canada Gas Line Plans Move Rapidly Forward, by W. L. Dack

94 Sun-Sarnia Refinery on Stream, by John L. Cushnie

98 Alberta Natural Gas, by Floyd K. Beach

102 Oil Reserves of Alberta, by Theo. A. Link and John A. Downing

106 Active Pipe Line Construction Continues in Canada

110 1953 Geophysical Activity in Western Canada, by John A. Legge, Jr.

113 Canadian Oil Consumption 9.7 Percent Higher in 1953

116 Pressure Maintenance in Western Canada, by R. R. McDaniel

120 Evolution of a Refinery, by P. Gordon and G. Davidson

124 Crossing of the Mackinac, by Joseph S. Troxell

128 Alberta Completes Active Year, by J. L. Irwin

130 Saskatchewan Oil and Gas Developments, by R. Pot

132 New Blending and Packaging Systems Feature Montreal Oil and Grease Plant, by E. A. Smith

138 Canadian Capital Expenditures $30 Billion in Seven Years, by Gordon R. Ball

148 Canadian Refinery Capacity Rose 11 Percent in 1953

158 Drilling Operations in 1953

168 One New White Rose Station per Week Being Opened

170 British Oil News

178 Manitoba Production Increases Rapidly, by Leslie Orr Rowland

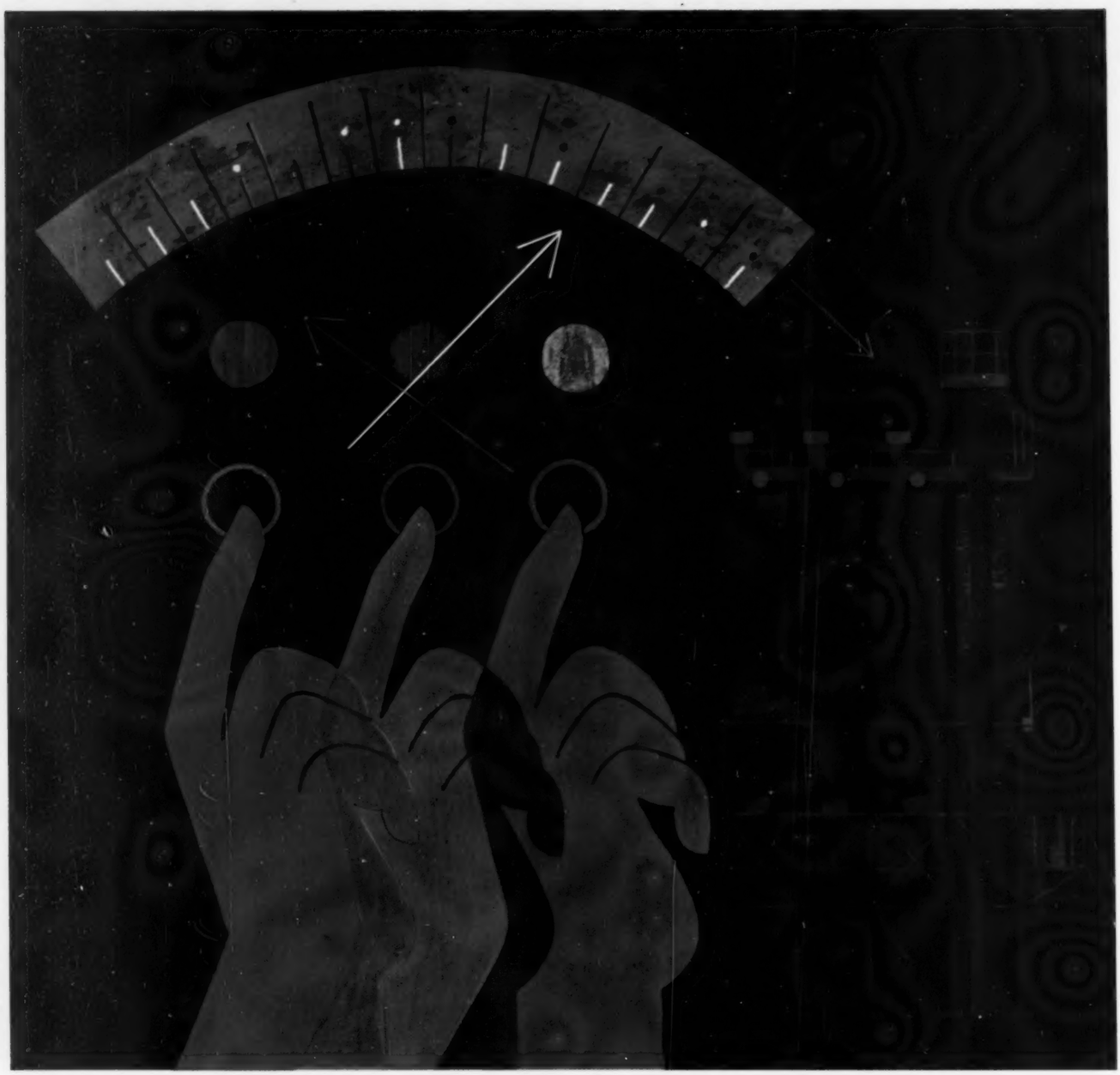
200 International News and Notes

204 Oil Company Staff Changes

224 Advertisers' Index

THIS MONTH'S COVER

Water color by John Tissavary, WORLD PETROLEUM art director, shows Houdriflow catalytic cracking unit and Houdriformer at Sun Oil Company's new Sarnia, Ont., refinery which is to be formally opened on May 15. The plant is a 15,000 b/d unit designed for maximum gasoline production and is equipped with a two-reactor Houdriformer for naphtha upgrading. The Houdriflow cat cracker has a charge rate of 11,500 b/sd, coke burning capacity of 6,000 lb/hr, and catalyst circulation rate of 350 tons/hr. The plant was designed and built by Catalytic Construction Co. of Philadelphia.



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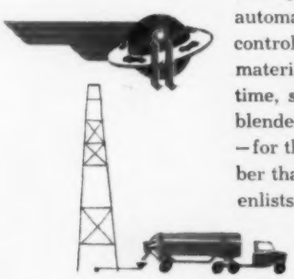

The cybernetic age, we're told, is already here. In simplest form it means that operations are automatically controlled by electronics. One way that Halliburton uses cybernetic principles is in control of batch mixing materials at its bulk cement stations throughout the country. Cement materials for each well are specially selected to combine properties of thickening time, setting time, strength, corrosion resistance, perforating qualities, etc. Correct proportions, thoroughly blended, are of major importance—accuracy in weighing and measuring is extremely necessary—for the control of cements is what makes cementing effective. Next time you're W.O.C. remember that Halliburton, in addition to its two-million-job experience and quarter-century research, enlists the aid of cybernetics to keep cementing under control.

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A bright future

THE PROVINCE OF ALBERTA is one of the few areas in which oil exploration over large tracts of undeveloped territory is not restricted by state control or other monopolies. In Alberta vigorous competition is encouraged with a minimum of restrictions and regulations.

The success of this policy is demonstrated by the fact that oil became Canada's principal mineral less than seven years after the discovery at Leduc. In the past year the industry invested approximately $280 million in oil and natural gas exploration and development. The industry estimates that expenditures in 1954 will exceed $300 million.

In the past seven years, Alberta's oil production potential has increased by 300,000 barrels per day. At the present time our natural gas reserves are increasing by 1.5 trillion cubic feet per year. With substantial markets available for crude oil production and provision being made for the export of surplus natural gas, maximum exploration and development is assured for some years to come.

ERNEST C. MANNING, *Minister of Mines and Minerals*

Surveyor checks a Socony Vacuum Exploration Co. claim post in the Northwest Territories.

R. H. C. Harrison, Q. C., joined the British American Oil Co. as western counsel shortly after World War II. He was later appointed western manager of crude oil purchasing; vice president of B. A. Alberta Pipe Line Co. and Saskatchewan Pipe Line Co.; and was appointed public relations officer of the company for the Prairie provinces. In 1951 he resigned from British American to assume the presidency of the Western Canada Petroleum Association, now the Canadian Petroleum Association. The Canadian Petroleum Association is recognized as spokesman for the oil business in Canada. Its members produce or refine over 97 percent of Canada's crude production. The association has a paid administrative staff and a number of standing committees to deal with problems of the industry.

Western Canada today

By R. H. C. Harrison

President, Canadian Petroleum Association

THE CANADIAN PETROLEUM and natural gas industry is looking to the future with a high degree of optimism.

The optimism of the industry is based on several factors. One of the factors is the size of the oil hunting ground in Western Canada which covers some 770,000 square miles. Another is that the industry has only scratched the surface as far as oil exploration is concerned. In Western Canada to date, only one well has been drilled for every 178 square miles of potential productive area.

Another basis for optimism is the rate at which oil has been discovered over the past seven years. These discoveries have demonstrated that not only is the prospective area in Western Canada very large, but that production can be obtained in many different geological formations. While many factors will, of course, determine the rate at which exploration will continue to be carried on in Western Canada, the industry is definitely optimistic as to the future.

In 1946, Canada's total reserves of crude oil were in the neighborhood of 72,000,000 barrels. At December 31, 1953, Canada's proved recoverable oil reserves were estimated at 2.044 billion barrels, which is an increase of one sixth over the previous year.

The wells of Western Canada produced, on the average, some 21,000 barrels of oil a day in 1946. Today, they are producing about 250,000 barrels per day. This means that in 1946, Canada produced less than 10 percent of her oil needs; in 1953, she produced 44 percent of her oil requirements—in spite of the fact that consumption of oil in the same period more than doubled. Today's potential production could satisfy 69 percent of Canada's present demand.

One of the best examples of Canadian development is the money being spent by the industry. Back in 1946, the two dozen or so oil companies which were operating in western Canada spent about $1 million a month on oil exploration and development; in 1953, there were 240-odd exploring and producing companies in the west and they spent about $1 million a day. It is estimated that during 1954 approximately $400 million will be spent on Western Canada's exploration and development.

Imperial Oil's refinery at Calgary is not on fire—it's "smice." Los Angeles has its smog, but in Canada it's "smice" at 40 below, when the slightest trace of water vapor is instantly transformed into a cloud of minute ice crystals.

Another significant fact is that in 1946, 20 million acres of land were being explored, while at the end of 1953, 183 million acres were under exploration. Geophysical parties increased from 11 in 1946 to 172 in 1953.

Since 1946, refinery capacity in the Prairie provinces has tripled. In addition to the great increase of supply of crude oil, there has been a corresponding increase in the local supply of petroleum products.

Canadian producers consider refinery expansion of the Pacific Northwest of great importance. British Columbia's refinery capacity will be increased to more than 50,000 barrels per day in 1954, and Canadian crude also will supply General Petroleum's new refinery in Washington. The General Petroleum refinery is scheduled for completion late in 1954 with a daily capacity of 35,000 barrels. Shell Oil's 50,000 barrel per day refinery at Anacortes, Washington, should be completed late in 1955, and Pacific Oil and Refining Co. at Tacoma is due to start construction of a 12,000 barrel per day refinery.

This expansion means that the refineries of the Pacific Northwest could have a capacity of approximately 150,000 barrels per day late in 1955.

Pipe line development has created new markets for Western Canada's crude oil in recent years. Canada's pipe line mileage has jumped from 435 miles in 1947 to 3,924 miles in 1953. In 1950, the Interprovincial pipe line was built from Redwater in northern Alberta to Superior, Wisconsin, at the head of the Great Lakes, from which point tankers carried large quantities to Ontario refineries. The building of this line enabled western crude not only to satisfy the entire Prairie's demand for crude, but also to transmit crude in sufficient quantities to satisfy over two-thirds of Ontario refineries' crude requirements, deliver 4,000 barrels daily to a refinery in Wisconsin, and 8,000 daily to a refinery in Minnesota. Interprovincial has extended this pipe line to Sarnia by constructing a further 635 miles of 30-inch pipe through Wisconsin and Michigan. The initial capacity of the extension is 100,000 barrels daily, with the initial throughput estimated at 83,500 barrels per day.

Recently, Trans Mountain Pipe Line completed its line from Edmonton to the Pacific Coast, resulting in western crude entering the British Columbia crude oil market. The initial capacity of this pipe line is 120,000 barrels per day, but it will have a capacity of 150,000 barrels per day by July 1954.

With 14 pump stations, Trans Mountain Pipe Line can be increased to 300,000 barrels per day. The total cost of these two pipe lines when completed will be approximately $300 million.

The findings of the Alberta Petroleum and Natural Gas Conservation Board on proven gas reserves were most encouraging. The findings indicated that, as of June 30, 1953, Alberta alone had proved gas reserves of 11.5 trillion cubic feet. Progress made toward building a gas pipe line to eastern Canada indicates a market for these reserves.

Natural gas development has brought petrochemical plants to Western Canada. Using natural gas as a base material, Consolidated Mining & Smelting Company's plant at Calgary manufactures ammonia and ammonium nitrate fertilizers, with a world-wide market. Shell Oil and Royalite Oil produce sulfur from sour gas at Jumping Pound and Turner Valley respectively. Both these plants produce 30 long tons of sulfur per day. Canadian Industries Ltd. has completed an explosives plant south of Calgary, using ammonium compounds from natural gas.

The northern part of the province of Alberta is now entering the petrochemical industry. Canadian Chemicals is completing a $55 million plant which started initial operation in June 1953. The raw materials for the chemicals will be from natural gas and a high alpha wood pulp from an associated company at Prince Rupert. The company will make a number of organic chemicals, some of which have never before been produced in Canada. Among the products will be cellulose acetate, acetate staple fiber, and filament yarn.

Canadian Industries Ltd. is completing a $13 million plant at Edmonton which should be in operation shortly. From natural gas, this plant will produce about six thousand tons of polyethylene flake a year. This is eight times the amount presently available in Canada through import from the United States and the United Kingdom. The flake from this Edmonton plant will be shipped to Shawinigan Falls for fabrication.

Sherritt-Gordon Mines Ltd. is now entering the petrochemical field. A $17 million plant at Fort Saskatchewan will use a leaching agent for the recovery of nickel, copper and cobalt. The excess ammonia will be used for the production of chemical fertilizers.

To summarize, there is every reason to believe that the petroleum and natural gas industry, particularly if gas finds the market it should, will continue to expand in volume and area. This in turn should increase the benefits that industry generally will receive and also increase incentive for further exploration and development.

Shell Oil Company's Peers No. 2 wildcat drilled in the muskeg country about 90 miles west of Edmonton, which may indicate a 30-mile extension of the Pembina field. The well found oil in the Cardium at 4,950 to 5,003 feet and an encouraging show in the Viking at 5,935 to 5,973.

N. E. Tanner, formerly Minister of Mines and Minerals for the Province of Alberta, has been elected president of Trans-Canada Gas Pipeline.

Trans-Canada gas line plans move rapidly forward

By W. L. Dack

THE JIGSAW PIECES of the most ambitious natural gas pipe line project ever planned are now falling into place. First construction on the 2,240-mile long big inch gas line to join Alberta gas fields with the big eastern Canada market is scheduled to get underway by next spring.

Designed to move some 500 million cubic feet daily, the line will be built in two stages: from an eastern Alberta export point to Winnipeg, Man., in the first step; from there the rest of the way to Toronto, Ont., in the second step.

The Alberta-Winnipeg section will be of 36-inch diameter pipe and will travel almost due east across the southern end of the three Prairie provinces. A 24-inch spur line will extend south from Winnipeg to Emerson on the Manitoba-Minnesota border, from which point Northern Natural Gas proposes to pipe a minimum of 100 million cubic feet daily to the St. Paul-Minneapolis area.

The Winnipeg-Toronto section will be of 30-inch diameter pipe and will swing around the northern end of the Great Lakes through the rugged terrain of northern Ontario and then southeast to Toronto. A spur line, probably 24 inches in diameter, will extend eastward to Montreal, Que., another 400 miles.

The first construction step will be finished by late fall of 1955, and gas should be moving to Winnipeg before the end of the year. St. Paul and Minneapolis also will be served by that line if Federal Power Commission approval is forthcoming in time.

While Trans-Canada Pipeline officials claim it is their intention now to push on to eastern Canada in the second construction season, they admit the recently concluded plans to build up the eastern market first with imported U. S. gas might postpone this phase of the project one year.

Cost of the main transmission line, to be the longest in the world, is estimated at $300-$350 million. Total investment in the entire Trans-Canada pipe line system, including an extensive gas gathering system in Alberta and Saskatchewan, gas treating plants in chief export fields and distribution lines in the east, is placed at around $700 million.

Although all the money is to be raised by public and institutional financing, the federal government may have to assist to the extent of easing import duties on pipe and other equipment and perhaps even guaranteeing the pipe line bonds.

Final Trans-Canada hearings before the Alberta Petroleum & Natural Gas Conservation Board on the marketing and financing status of the project were completed recently. These are looked on as a formality, since the Alberta government has already all but committed itself on the project. The full provincial go-ahead signal is expected within the next week or two.

The next official step will then be to gain the approval of the Federal Board of Transport Commissioners, which is necessary in any project involving export of gas or oil over provincial or international boundaries. But this also has been more or less promised. At this stage, however, the thorny matter of government assistance is likely to be brought up, and final approval might be held up for a week or two.

The final go-ahead sign from Ottawa, which is expected before end of May, will be the signal for an outburst of activity on the part of Trans-Canada management. First and most pressing task will be to assure delivery of sufficient 36-inch pipe during the next construction season to enable completion of the line as far as Winnipeg. Since there are only two mills in the United States, none in Canada, and one each in England and Germany be-

lieved capable of turning out such large diameter pipe, deliveries will be a major factor in the pipe line timetable.

Next, a top engineering firm will be retained to complete intensive survey of the pipe line route and draw up a program of work activities. The actual line construction job is so large that an estimated 20 different spreads will likely be working on it at one time. Recently Trade Minister D. C. Howe estimated that on the basis of the "labor count" of other major pipe lines which have already been laid in Canada, some 3,000 man-years will be required to clear the right-of-way and to install the main transmission line. Several times this number of man-years will be required "on-site" to complete the necessary gas-gathering and distributing facilities on the Prairies and in eastern Canada.

The line proposes to serve a large part of urban Canada made up of nearly all the main cities between Alberta and Montreal, Que. In this territory some 4.5 million people live in more than 200 communities and the bulk of Canada's manufacturing is carried on. A marketing survey done by Ford, Bacon & Davis estimated that Trans-Canada could have 857,-068 residential and commercial customers at the end of the fifth year of operation, representing a total consumption of some 138 billion cubic feet annually.

Marketing surveys have shown considerable variation, particularly as to the part the industrial market will play in the overall load picture. Relatively little importance was given the industrial load, for instance, in the Ford, Bacon & Davis survey. At least two other major marketing surveys insisted that industrial load would have to make up a big part of the total pipe line load for several years, and after that there would have to be a continued heavy reliance on industrial interruptable load for many years.

The surveys generally agreed that the competitive price of natural gas with other fuels would be around 65 cents per Mcf at eastern city gate, or $1.01 per Mcf delivered to the average user. Wellhead gas price was figured anywhere from 8.8 to 10 cents per Mcf.

The project is believed unique in that some 70 percent of the entire potential market will rest on the remote end of the line and that en route to the heavily populated Ontario - Quebec market, the line will pass through several hundred miles of rugged, sparsely-populated country.

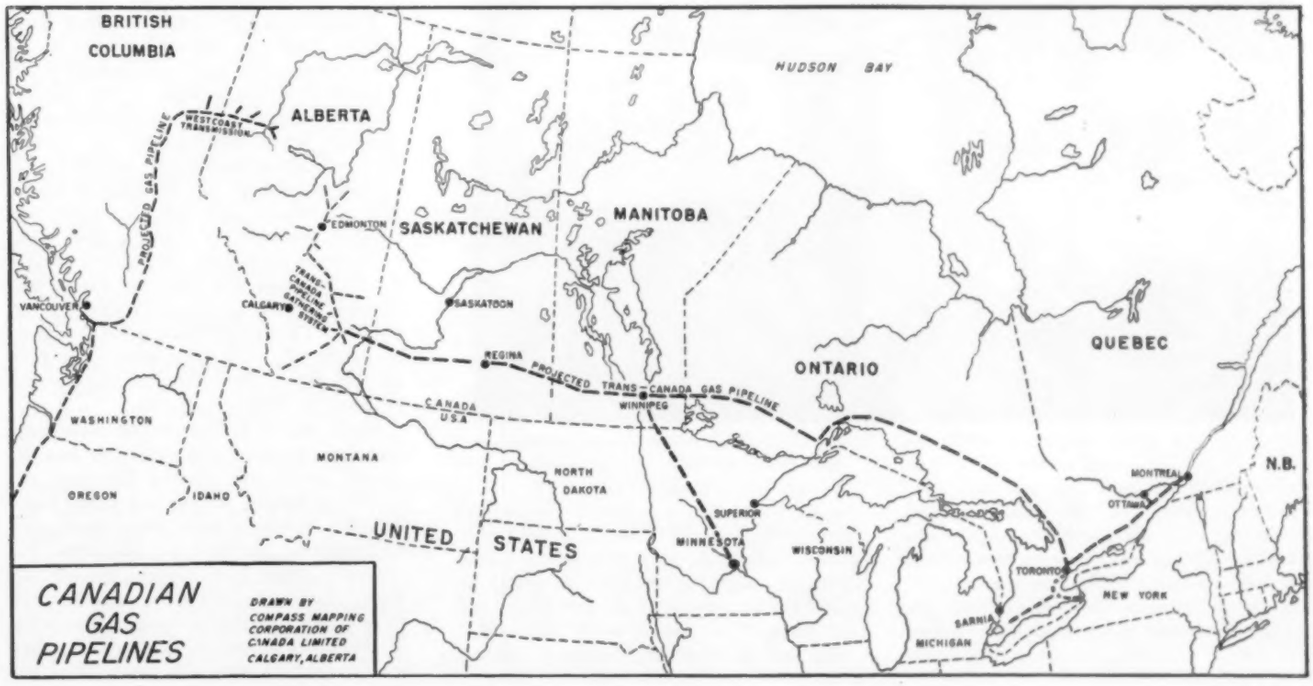
Extensive surveys into the economic feasibility of such a line have all agreed on one point: only by making use of the transportation economies of moving a large quantity of gas through a big inch pipe line can western gas be laid down at eastern points competitively with other fuels. But this in turn raises the question of how to dispose of such large deliveries in the relatively undeveloped gas markets of Ontario and Quebec.

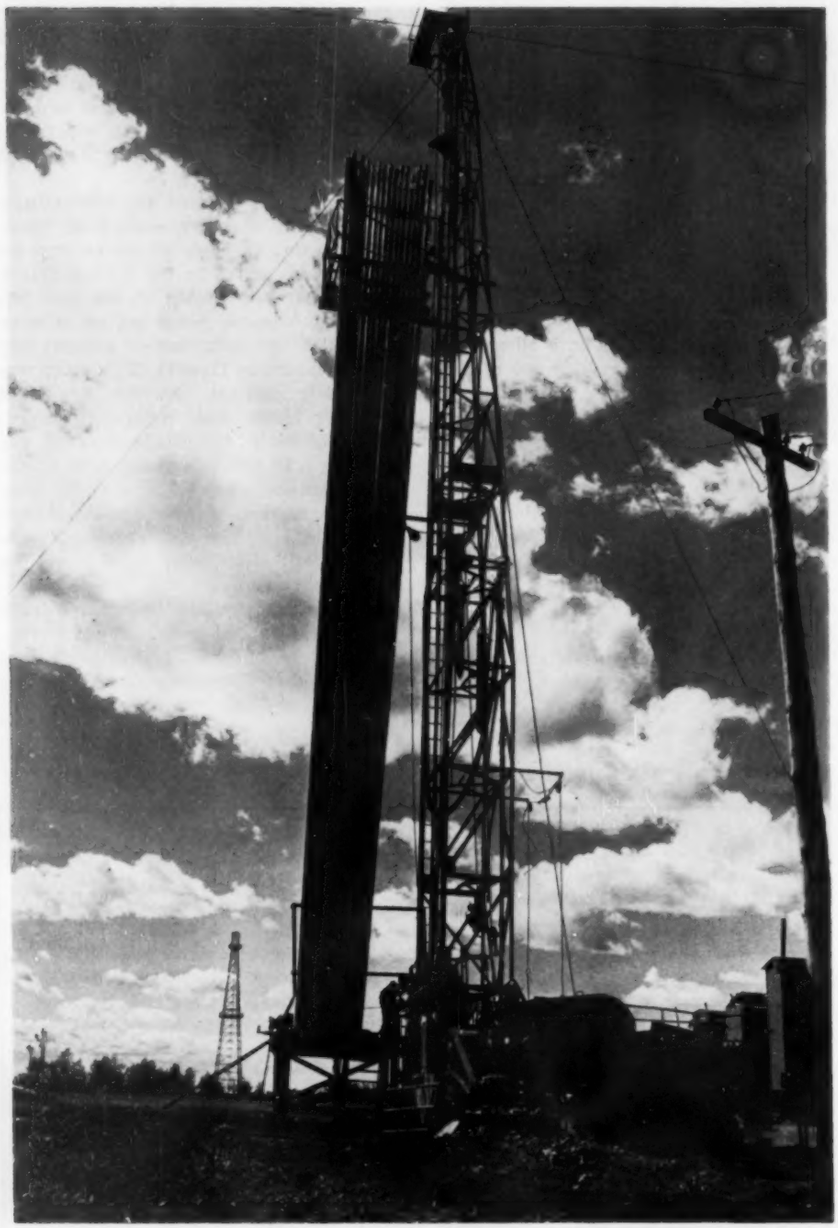
To overcome the obvious difficulties in early years of operation, an ambitious eastern market build-up program has been drawn up. This will involve importing Texas and Louisiana gas at a Niagara crossing point for distribution in the Greater Toronto metropolitan area. In a second eastern phase, gas from southwestern Ontario storage fields will be distributed by a new pipe line to Hamilton and intervening cities.

Plans for both these eastern build-up projects are now being finalized, and it is expected that both the new lines involved will be completed by fall and gas moving by year-end. These projects assure that there will be a sizeable market developed by the time the Alberta gas arrives. Arrangements are being worked out whereby both the U. S. gas and the southwestern Ontario gas can be replaced by Alberta gas once the trans-Canada line is completed.

As originally planned, the Toronto utility company and Tennessee Gas Transmission Co., through whose system the gas will be moved in the United States, would share ownership of the new gas pipe line company being set up to move some 21 billion cubic feet of gas annually from Niagara to Toronto. This setup was vigorously opposed, however, by Trade Minister Howe, most influential government figure in the whole involved gas question. To preclude the danger of the U. S. gas indefinitely taking over the juicy Toronto market, a new agreement has finally been worked out whereby Trans-Canada will take over control of the Niagara-Toronto pipe line.

In the new plan, the Niagara-Toronto pipe line, estimated to cost around $7 million, will be built by Trans-Canada and then leased to Consumers' Gas Co. of To-





Alberta Government photograph.

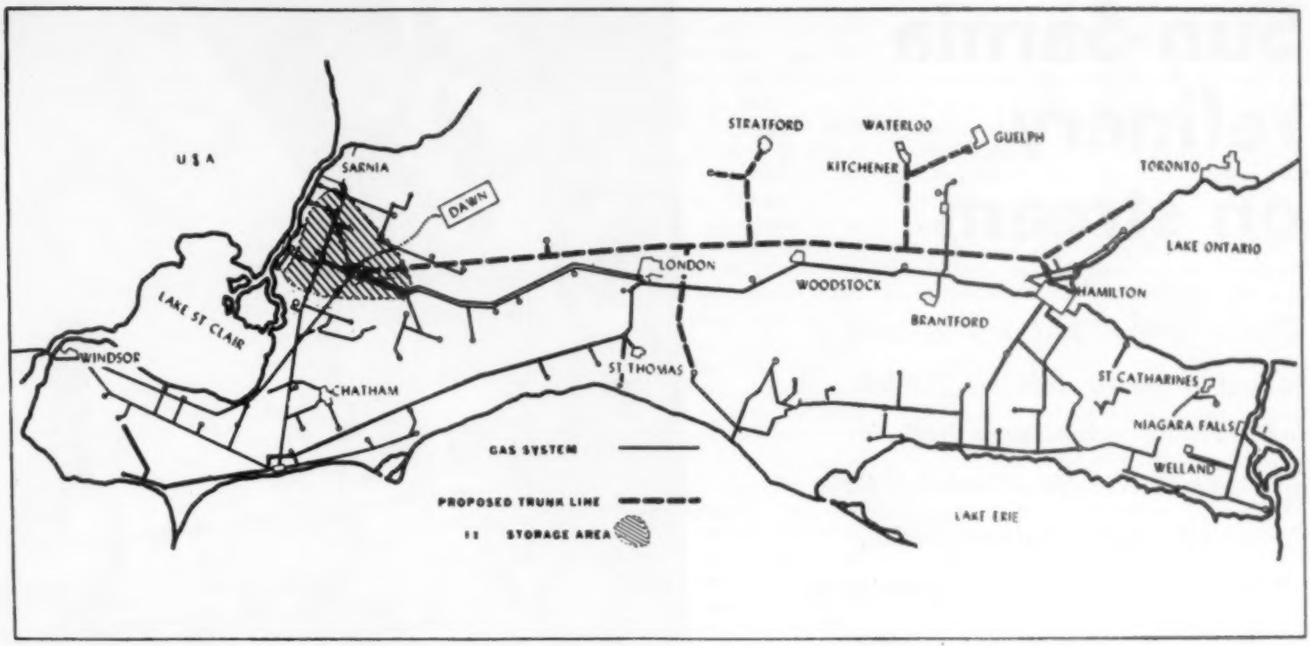
ronto until Alberta gas is available, probably in late 1956 or 1957. Trans-Canada undertakes to have the line completed by November 1 of that year. Tennessee Gas, a party to the agreement, will have to build some 45 miles of line to join with the Canadian line at the border. Present plans do not envisage the use of the line for a reverse flow into the U. S.

In the other eastern build-up plan, Union Gas Co. of Canada has already started arranging for franchises with southwestern Ontario townships preparatory to purchasing right-of-way for its proposed 160-mile gas line from Lambton County eastward to Oakville, Ont. If everything works out satisfactorily, Union could complete the line by next fall and first deliveries of natural gas would be arriving at Oakville, Hamilton, Guelph, Kitchener, Waterloo, St. Mary's, and Stratford before year's end. The plan is to build up this large potential market area with gas reserves from Union and Imperial Oil Ltd. wells in southwestern Ontario and gas presently being imported from Panhandle Eastern Pipeline Co. in the United States. Once the line from western Canada is completed, Union's depleted gas supplies would be replaced with gas from Alberta. Thereafter the line and the highly important Dawn storage field would be integrated into, and play an important part in, the overall Trans-Canada system.

An important governing factor in the whole gas question has been the need for speed in arranging for early market outlets for Prairie surplus gas. Hundreds of gas wells, most of them discovered incidentally in the search for oil, have had to be capped for lack of markets. One oil concern is sitting on proven reserves of three trillion cubic feet.

The Alberta government has been hard-pressed from two opposing groups within the province; the very vocal group which wanted to keep the bulk of the gas for Alberta's future use, and the petroleum industry, which has been urging development of export markets in order to realize some returns on its capped assets. But the rate of new gas discoveries has boosted reserves to such a level that even the most ardent supporters of provincial interest now have to admit that early export is essential. Petroleum interests are warning that any further postponement of marketing plans will tend to slow down the tempo of the current oil boom in Western Canada.

Never has such controversy raged over pipe line markets and routes as has attended every step in the five-year gas market struggle. At various times three different markets have been considered for western gas, and no less than five different pipe line routes of serving them. Along the way five major surveys were made into the economic feasibility of the main proposals, and several other smaller surveys were also made. Through-



Map showing present gas pipe line system in Ontario with proposed trunk line to be laid in preparation for importation of western gas. It is planned to deplete the present field south of Sarnia by heavy withdrawals while Trans-Canada is being built and subsequently to use the field for underground storage to meet peak winter demands.

out most of the prolonged controversy, western gas producers and the Alberta Government have advocated a different market than that proposed by Ottawa. While Alberta has the say as to whether there will be gas export out of the province, the federal government has final say on markets and pipe line route since its approval is necessary on any pipe line crossing a provincial or international boundary.

Most western petroleum people and Alberta Government officials have continually favored a line east to Winnipeg and then a spur line south to feed the promising St. Paul-Minneapolis market. They have pointed out that this is the only firm market offered the Trans-Canada project at the present time. It is a fast-growing market and hundreds of miles closer to the gas fields than Ontario and Quebec cities. The eastern market should be built up for several years, some say five to seven years, by imported U.S. gas. When this market has grown attractive enough to justify continuance of the Trans-Canada line, it could then be extended eastward, preferably south to the Great Lakes via a route paralleling the Interprovincial oil pipe line.

The federal government has stuck fairly rigidly to its gas export policy as laid down last spring by Trade Minister Howe: no gas export to, or line through, the U.S. until eastern Canada's long-term gas requirements are met and a trans-Canada line well on its way to completion. Since then, western interests have realized that any export proposal out of the west must have as its chief market objective the big, but far-distant Ontario-Quebec market.

It is considered significant that Trade Minister Howe is now known to have relaxed his position on export to the extent that he will approve export to the United States midwest if it can be demonstrated that such export will not jeopardize eastern Canada's long-term needs. At the rate gas reserves have been piling up in the last couple of years, gas officials see no difficulty on this point. Northern Natural Gas has already made application to the Federal Power Commission for permission to build the necessary pipe line from the border to St. Paul and Minneapolis.

Trans-Canada Pipe Lines Ltd. has grown out of the merger of two competing pipe line companies, a company of the same name which proposed pretty much the same general pipe line route, and Western Pipe Lines Ltd., which proposed a line east to Winnipeg with a spur to feed the U. S. midwest market. Board of directors of the new "merged" company are made up of the chief officers of the two former companies.

The former Trans-Canada Pipe Lines, now sharing 50-50 with Western in the new company, is controlled by Delhi Corp. in the U. S., whose leading figures are Clinton W. Murchison and his head of operations, Frank Schultz. Financial backer is the New York investment house of Lehman Bros. In Canada, McLeod, Young, Weir & Co. is behind the project.

Western Pipe Lines is headed by Gorden P. Osler, president of the Winnipeg investment house of Osler, Hammond & Nanton. Oilman Ray Milner has also thrown his weight behind the project. Other Canadian backers are: Wood, Gundy & Co.; Nesbitt, Thomson & Co.; Anglo Canadian Oil; Calgary & Edmonton Oil; and International Utilities Ltd.

N. Eldon Tanner, western oil executive, heads up the giant new pipe line project. For 15 years Mr. Tanner was the Minister of Lands & Mines in the Alberta government. Lately he has been president of Merrill Petroleums, prominent in the Pembina oil field in central Alberta.

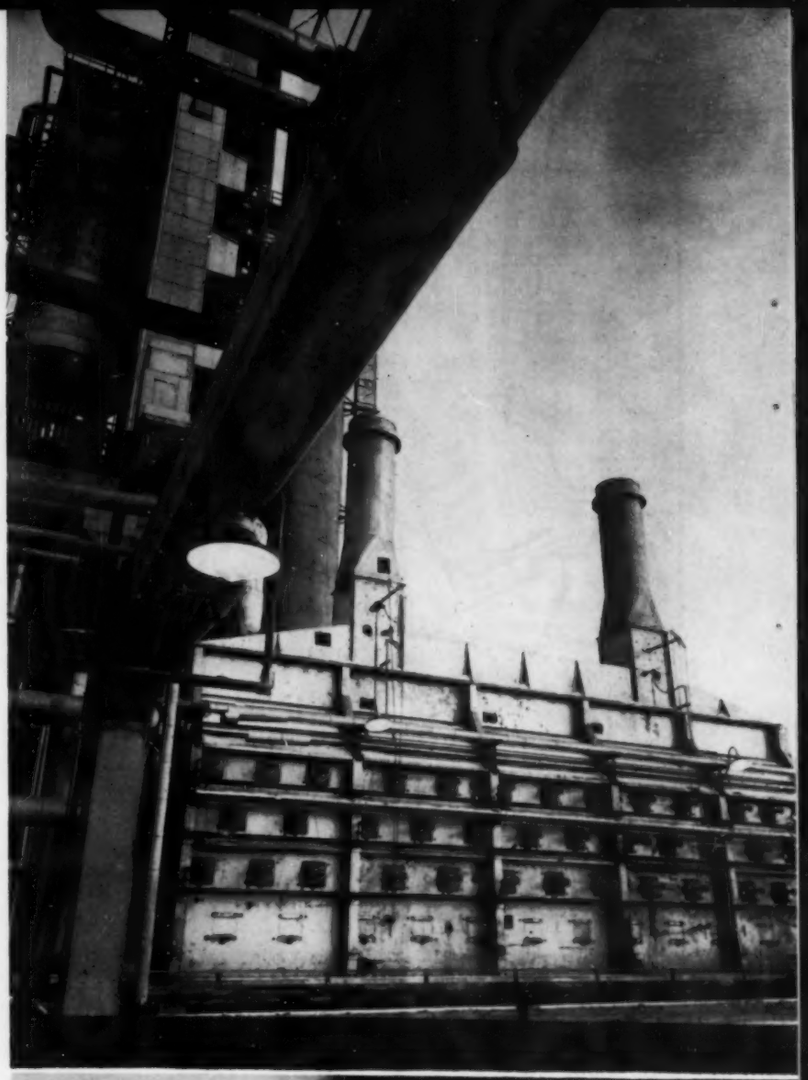
Early financing plans are to be arranged for $36.5 million in common shares, $36.5 million in debentures and $219 million in first mortgage bonds.

The operation of Trans-Canada is expected to give a tremendous boost to the fast-moving petrochemical industry in Canada. Several of the major gas fields will provide plentiful supplies of by-product hydrocarbon gases which contain the chemical building blocks for a broad range of products. Since most of these by-product gases will have to be extracted at the field to put the gas in transportable form for its long trek eastward, there will be a strong incentive for these plants to locate in the west, close to the major export fields.

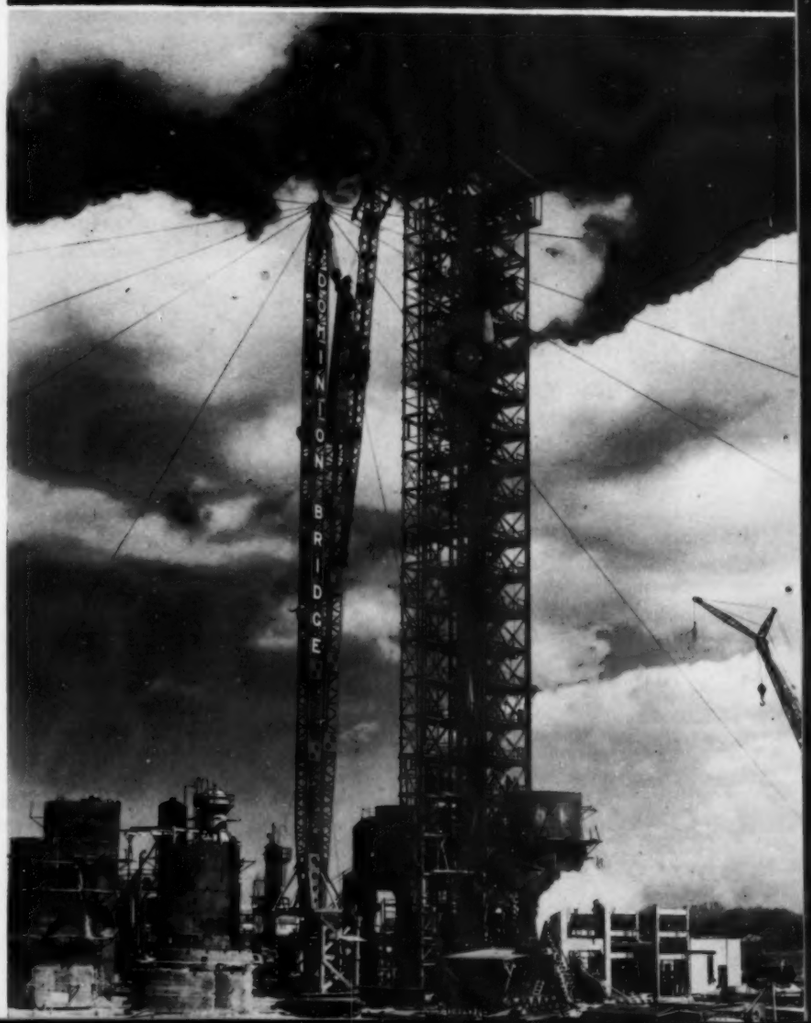
It is certain too that the methane to be piped east will be readily used in new plants for producing hydrogen and ammonia in eastern Canada. The outlook for ammonia as fertilizer and as a leaching agent in the new chemical metal recovery from base metal ores is particularly bright.

Sun-Sarnia refinery on stream

Elaborate precautions to prevent stream or air pollution have been incorporated in Sun's new Sarnia refinery. Bacteria are used to oxidize effluent waters in the first oil refinery installation of its kind. All gases relieved from operating equipment are collected for condensation and burning.



Two-coil reformer furnace has space for adding a third coil and will contain 125 radiant type burners with ceramic cones. A steam convection coil is installed for improved thermal efficiency. Total heat absorption is 24 million Btu/hr.



Dominion Bridge Co. erected a 150-ton guy derrick with a 180-foot mast and 160-foot boom, the largest ever employed in Canada to raise steel. Heavy vessel assemblies were erected 145 feet above grade and structural steel at a height of 250 feet.

John L. Cushnie was project engineer for Catalytic Construction Co. during the construction of the Sun Oil Company Ltd. Sarnia refinery. Mr. Cushnie has been engaged for the past 14 years in the chemical, petrochemical and petroleum fields involving process design, pilot plant operations and project engineering. He has been with Catalytic for three years. Previously he worked for Caltex, du Pont and the Barrett Division of Allied Chemical and Dye.

By John L. Cushnie

THE SUN OIL COMPANY LTD. has recently gone on stream at its Sarnia, Ontario refinery, which is the latest addition of completely new facilities to Canada's rapidly expanding petroleum industry. On a 196-acre site which less than nineteen months before had been a sprawling Indian reservation now stands a modern refinery ready for the processing of 15,000 barrels of crude per day.

The erection of this refinery is a milestone in the service of Sun Oil Company Ltd., a wholly-owned subsidiary of Sun Oil Company, which for over 30 years has been marketing petroleum products in the Provinces of Ontario and Quebec. At present a sweet crude is being used, but with extensive modifications this plant would be suitable for sour crudes.

The ever-increasing requirements for petroleum products in Canada had indicated the feasibility of such a plant, but with the continuation of the Korean war this changed practically to a necessity. The utmost in cooperation was obtained from the various agencies of the Canadian and United States Governments for its construction, showing the importance of this refinery to these two neighboring countries in the allied free world. In addition to the vitally important gasoline, kerosine and fuel oils produced, quantities of by-product unsaturated hydrocarbons are sent by pipe line to the adjacent Polymer Corporation for the manufacture of synthetic rubber.

Numerous factors contributed to the selection of the "Chemical Valley of Canada," as Sarnia is known, for the site of this new refinery. Transportation by railroad, highway and the Great Lakes waterway is readily available. The St. Clair River, on which the refinery borders, is an exceptionally fine source of cooling water for the process units. Electric power is available from the Hydro-Electric Power Commission of Ontario. Another factor was the existing pipe line then being used by Sun Oil Company for the transfer of hydrocarbons from its Toledo, Ohio refinery to the Polymer Corporation. This pipe line is now being used to bring in crude for the present operations.

The major sections of the process area or combination unit are the crude unit, the atmospheric flash unit, the Houdriflow catalytic cracking unit, the synthetic crude unit, the gas plant, the Houdry catalytic reformer unit and the B-B rerun unit. Sun Oil Company did the process design for the entire refinery except for the catalytic section of the two Houdry units, which work was done by the Houdry Process Corporation. Catalytic Construction Company, through its Canadian subsidiary, Catalytic Construction of Canada Ltd., was the engineering and construction contractor for the project. Throughout the combination unit provisions have been made for the addition of future facilities as they are needed. It was also taken into consideration that at a later date additional combination units might be built.

The process requirements for the utilities and general services were developed by Sun Oil Co., while the design and construction were done by Catalytic Construction. These consist of a river water pumphouse with cooling water and fire protection water pumps, electric substation, steam generators with water treating facilities, distribution systems for plant air, instrument air, cooling water, fire protection water, fuel oil, fuel gas, steam and flue gas, a waste disposal system, conventional storage tanks and high pressure underground storage wells.

The engineering and construction of the river dock was sub-contracted to Canadian Dredge and Dock Company Ltd. For the office building and the service building with shops, warehouses and control laboratory, the engineering was sublet to Giffels and Vallet of Canada Ltd., and the construction was done by Catalytic Construction of Canada Ltd.

Because of the difficulty in obtaining early delivery of structural steel and also in the interest of economy, a large building at one time belonging to the Dominion Alloy Steel Corporation Ltd. was dismantled and the steel used in the construction of the service building. By doing this it was possible to have the service building available to the construction forces from close to the start of the project.

An accompanying schematic flow diagram of the refinery shows the various process units and their tie-ins. Two "crude" streams enter via pipe line from the Sun Oil Company refinery in Toledo, Ohio; one stream is crude oil and the other is a butane-butylene product contaminated by crude oil.

The crude oil after desalting is fractionated in the crude unit to produce light straight run (LSR) gasoline, naphtha, kerosine, atmospheric gas oil and reduced crude. The kerosine is treated to remove undesirable components, then run to storage tanks. LSR gasoline after treating joins the catalytic gasoline for further processing. The naphtha is charged to the Houdriformer where it is upgraded from a low octane material to a high quality gasoline.

The reduced crude or residuum from the crude unit is distilled in the atmospheric flash unit and the overhead product is combined with the atmospheric gas oil and charged to the Houdriflow catalytic cracking unit (HCC unit). The effluent from the HCC unit is fractionated in the synthetic crude unit to produce light and heavy catalytic gasoline and light and heavy catalytic gas oil. The residua from the atmospheric flash unit and the synthetic crude unit are partially used for fuel oil in the refinery and the remainder is run to tankage where it is blended with gas oils to make different grades of commercial fuel oils.

The light straight run and catalytic gasolines are combined with the vent gases from the crude, synthetic crude and B-B rerun units and are charged to the gas plant for the production of debutanized gasoline. The gases and light hydrocarbon liquid from the gas plant are transferred by pipe line to the Polymer Corporation.

The B-B rerun unit is used to remove all traces of crude from part of the butane-butylene mixture which is contaminated during transfer from Toledo in the same pipe line used for the crude. The crude removed is pumped to the crude unit for processing. The clean B-B resulting from the flash operation is sent to the Polymer Corporation for their use.

The control of all of these processing units is performed in the control house which is the "nerve center" of the refinery and is centrally located in the combination unit. One of the most unique features of this refinery is the extensive instrumentation, which was designed with the goals of maintaining perfect operation with the minimum of attention required of operators and also of protecting the process equipment from harmful or dangerous operation with little dependence upon the human element. Any deviation from the normal operation is immediately evident and is either self-correcting or can be corrected from the control house.

The instruments for the Houdriflow catalytic cracking unit are mounted on a graphic panel which clearly portrays the operation of this process. The instruments for the remainder of the process units are mounted on separate panels for each unit and are identified with name plates. Miniature instruments have been used wherever feasible to make the panels as compact as possible. In the center of the room is a console equipped with a dial system which gives the temperature of any thermocouple in the refinery by merely dialing its number.

The Ethyl blending building is equipped with an 8,500-gallon weigh tank and with Proportioneer automatic blending equipment which controls the addition of Ethyl fluid with varying rates of gasoline flow. This building has both water and kerosine showers for immediate use in case one of the personnel comes in contact with the Ethyl fluid during an accidental spill.

Since the crude for this refinery is brought in by pipe line, the amount of crude storage required is quite small, especially when compared with other installations in the same area which, until the recent completion of the Lakehead Pipeline, have had to depend upon shipping on a waterway which is frozen over during about five months of the year for their crude delivery. The total crude and product storage capacity is about 1,150,000 barrels.

Another unique feature of the storage facilities is the use of three high-pressure underground storage wells for light hydrocarbons. This is the first use of such

underground caverns as an integral part of a refinery. They were developed under the direction and control of the production department of Sun Oil Company.

Because of a natural salt stratum some 2,000 feet below the surface of the ground, it was possible to drill a salt well into this stratum and then with the use of two concentric pipes to "wash" out a cavern of desired capacity with fresh water. These same two pipes are now used for adding or removing hydrocarbons and saturated brine to or from a well: the center pipe is for the brine and extends almost to the bottom of the well, and the outer pipe, which only enters the top of the cavern, is for the hydrocarbons.

Hydrocarbons are charged to these wells by pumping at high pressure into the outer pipe and forcing the brine out of the well through the inner pipe. This saturated brine is then stored in a large pit for returning to the wells when it is desired to remove the hydrocarbons. In returning the brine to the wells only a few pounds of pressure are required since the head of some 2,000 feet with the very large difference in specific gravity between the two liquids develops a pressure of several hundred pounds per square inch at the hydrocarbon outlet.

To maintain a steady supply of brine available to the wells, brine is continuously pumped from the brine pit to the three wells. If hydrocarbons are being removed from one of the wells, the brine being pumped displaces it in the well. If no hydrocarbons are being added or removed, this pumped brine is relieved back to the pit. Similarly, when one of the wells is being filled, the displaced brine and the pumped brine are both relieved. In this manner the wells "float" on brine pumped from the pit.

There are five separate water systems located in the refinery: city water, treated water, cooling water, fire protection water and emergency cooling water. The city water is used principally for drinking and as feed to the water treating section. The water treating facilities consist of two sodium cycle ion exchangers and one chloride-bicarbonate ion exchanger. The treated water is heated with exhaust steam prior to deaeration and receives further preheat by process heat exchangers before use in the steam boilers and waste heat generators. To insure sufficient water for treatment during a temporary failure of city water, a 25,000-gallon storage tank is maintained at all times. In an emergency involving an even longer failure of city water, it is possible to use water directly from the river.

The cooling water and fire protection water pumps are located in the river water pumphouse adjacent to the St. Clair River. The lower level of this pumphouse is submerged with water fed from the river by a duct. A slotted crib located at the intake of this duct prevents any sizable pieces of debris or ice from entering. Any small pieces which may enter these slots are then removed by a traveling screen in the pumphouse before the water reaches the pumps.

The upper level of the pumphouse accommodates three vertical 5,000 gpm cooling water pumps, three vertical 1,500 gpm fire protection water pumps and the driving mechanism for the traveling screen. One fire protection water pump is diesel driven for use in case of power failure and the other five pumps are motor driven and can be operated from the pumphouse or from the control house in the combination unit.

The cooling water pumps are manifolded to a 30-inch reinforced concrete main which provides cooling water to all of the condensers and coolers in the combination unit. A closed return system is employed in running this used water to the cooling water separators. The fire protection water pumps discharge to a network of fire mains which service the entire combination unit and the storage tank areas. This network is equipped with hydrants having standard fire hose fittings in accordance with the Ontario civil defense organization's plan for standardization. Monitor nozzles are strategically mounted throughout the process area for instant use in case of fire.

A turbine driven pump taking suction on the city water storage tank automatically goes into operation when the normal cooling water fails. This emergency system provides cooling water to the bearings of all the steam turbines and the blowdown drum at the flare stack. No provision is made to furnish emergency cooling water to the remainder of the refinery since it is planned that all process units will be shut down immediately in case of cooling water failure.

A carbon dioxide truck is provided for rapidly extinguishing any fire taking place in the Ethyl blending and wet gas compressor buildings. Piping is furnished for directing the carbon dioxide from connections at the roadways which are readily accessible to the truck.

There are five individual sections in the waste disposal system of the refinery. These are for process water, contaminated storm water, cooling water, uncontaminated storm water and sanitary sewage. The process water section treats any water which has been in direct contact with oil and may contain an emulsion or a chemical contaminant, such as the desalting waste water, pump gland leakage and overhead accumulator draw-offs. First this water is passed through an API water-oil separator for the elimination of oil and sludge and is then thoroughly contacted with air in the presence of bacteria for the removal of phenols by oxidation before returning to the river.

The use of bacteria in the oxidation of phenols to reduce the phenol content of the total effluent water to low concentrations before return to the St. Clair River represents the first operating commercial-scale application of the process, long used by the chemical industries, to the purification of petroleum refinery waste water.

Achromobacter cruciviae bacteria seeded from a parent colony in the United States are located in the phenol oxidation bed. These bacteria feed on phenol and other wastes, oxidizing them to carbon dioxide and water: $C_6H_5OH+7O_2=6CO_2+3H_2O$. The water in the oxidation pit is kept saturated with air by means of mixing eductors to provide oxygen for the reaction.

The water in the phenol oxidation pit carrying the bacteria flows by gravity to a section of the contaminated storm water API separator which is temporarily used in this system. In this separator the bacterial flocs settle to the bottom where they are scraped to a gathering sump and then pumped back to the aeration pit. A portion of the clear effluent may be returned to the phenol oxidation pit for the dilution of the incoming contaminated process water. In order to maintain an active colony of bacteria, it is necessary to heat the water during the winter months. During plant shutdown, when there is no phenol in the waste water, the bacteria are fed with chemical grade phenol (purchased for this purpose) at regular intervals to maintain the colony.

The contaminated storm water section is for the disposal of all storm water accumulating in the combination unit area, the storage tank area, the pipeways and the adjacent roads. Because of the large acreage covered by the storage tanks, the flow of water from this area to the two API contaminated storm water separators is controlled to prevent their overloading. During a heavy rainfall, storm water is held within the tank firewalls and is not permitted to drain to the separators until the requirements from the other uncontrolled areas have diminished. Both of these separators are equipped with continuous mechanical and scraping equipment for the removal of oil and sludge.

The cooling water waste disposal system is for the treatment of water chiefly from cooling and condensing equipment in which no direct contact with oil is made. Nevertheless, all such water is passed through two API water-oil separators for the removal of any oil and sludge which may be present. The sludge from the contaminated storm water and cooling water separators is pumped to desludging pits where oily water separates upon standing and is then drained to the process water separator.

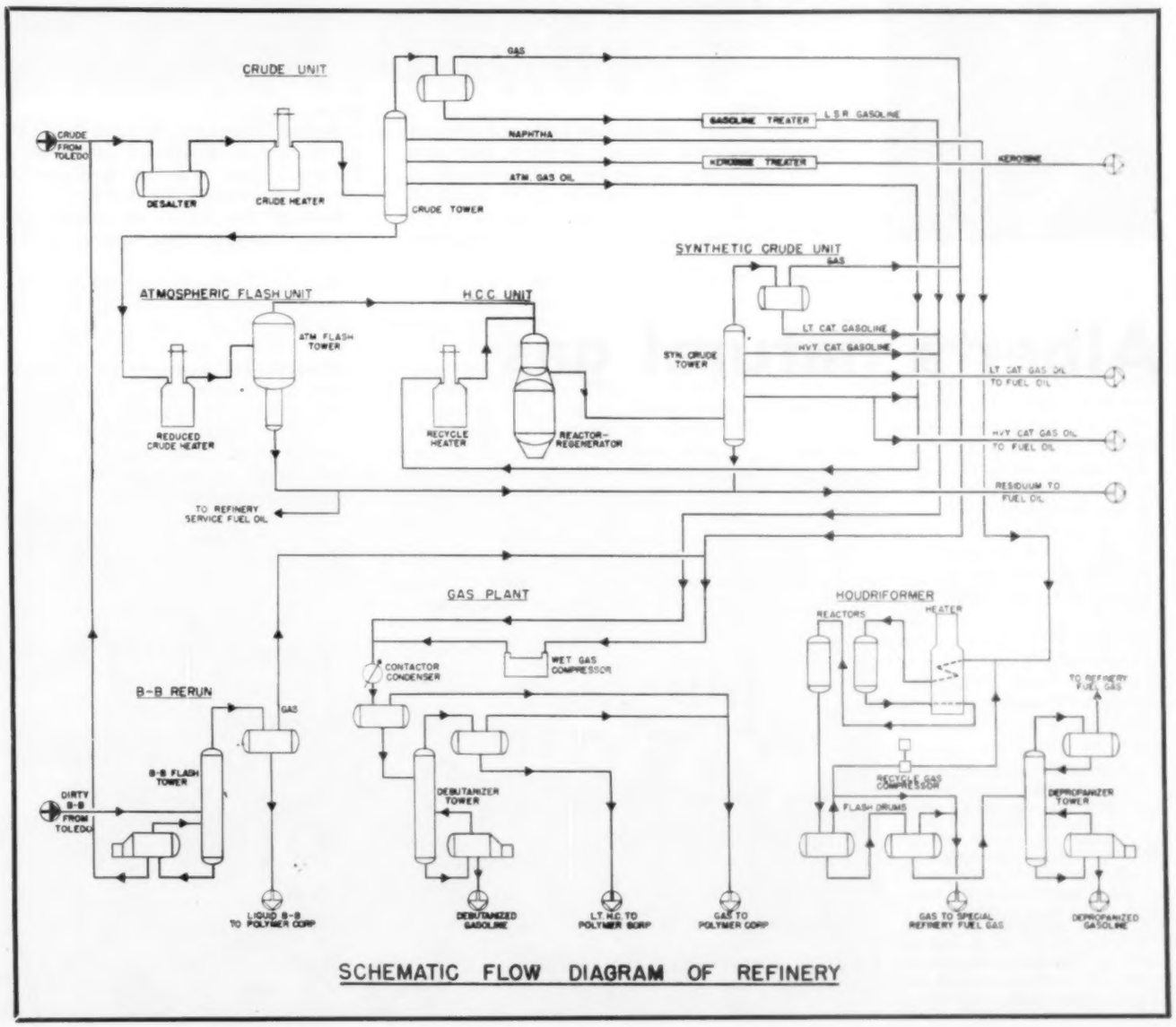
A conventional uncontaminated storm water sewer is used for the drainage of surface water from the remainder of the refinery tract which has no processing facilities or storage tanks. The sanitary sewage is treated in septic tanks.

Two 10,000-barrel tanks are used for bilge water from shipping at the dock. These storage tanks permit the rapid

(Continued on page 194)

Control laboratory.

Control house, showing graphic panel.



SCHEMATIC FLOW DIAGRAM OF REFINERY

Alberta natural gas

By Floyd K. Beach

Floyd Kellogg Beach of Calgary is a consulting engineer who has been intimately associated with Canadian oil and gas developments in Canada since 1927. He was in the Canadian army in World War I and served both Dominion and Alberta governments in an engineering capacity over a period of some 23 years before his retirement in 1950. In addition to his current engineering work, Mr. Beach is western field editor for Canadian Oil and Gas Industries. He has previously contributed special studies dealing with the development of gas reserves in Western Canada to WORLD PETROLEUM.

EARLY IN DECEMBER the Alberta Government announced that the Conservation Board had found that an exportable surplus of gas has been established. The complete printed report became available from the Queen's printer at Edmonton about the end of January (price $1.00). From that report and other data at hand, we may review the amount of gas reserves, where they are located, the proposed method of gathering gas for export, implications as to by-products, and plants needed to process the gas for transmission.

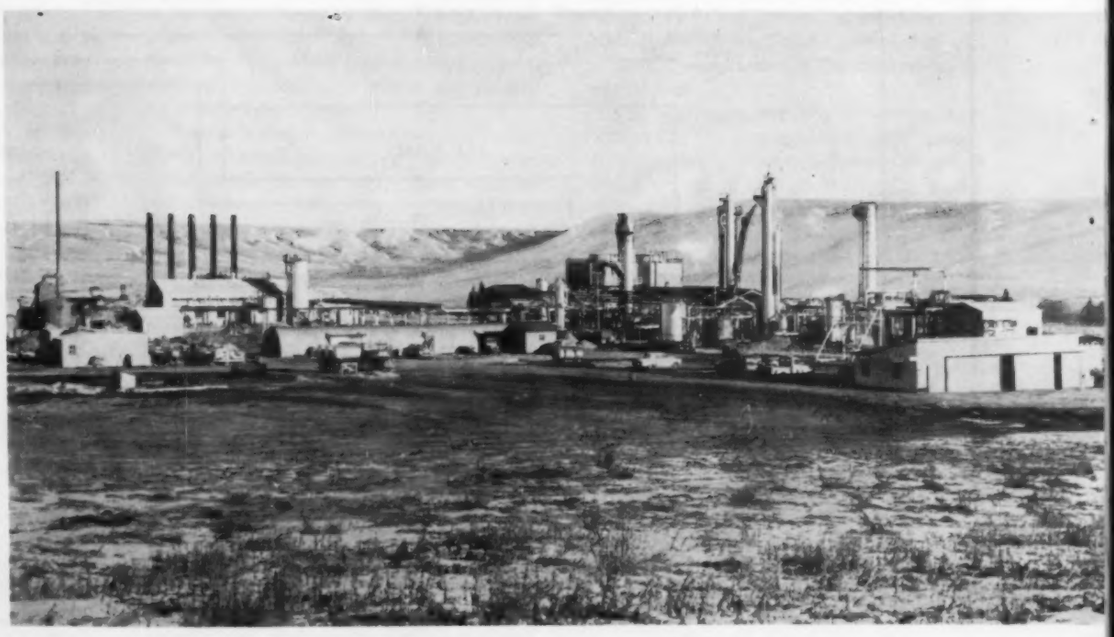
The Board's report was based, not only on estimates submitted by various applicants for the right to export gas, but on the very voluminous and complete records which every operator must submit in order to comply with the law and regulations as well. The Board's files should be more nearly complete than the data available to any applicant, for in an industry so highly competitive as is oil and gas, there is an understandable reason for operators to withhold information during periods when sales of leases are coming up, and this inherent difficulty in gathering data should be borne in mind.

Trans Canada Pipe Lines and affiliated companies engaged DeGolyer and MacNaughton to prepare a submission which reflected data available as of April 15, 1953. The submission consisted of six volumes about 9½ x 11 inches, requiring shelf room of 7½ inches and weighing 16½ pounds. The basic data may have been somewhat less complete than what was available to the Board, but over a period of nearly three years the consultants had spared no effort and expense to gather basic information. The writer acted as agent in collecting data and consequently is better fitted to comment on their submission than on the submissions of other applicants. We can observe that every occurrence of gas in Alberta of which there is a record was taken into account, and reserve estimates were prepared for all occurrences which appeared significant (provided data were available) although some occurrences that were evidently beyond economic reach have not been appraised. The submission was made by E. G. Trostel, a vice president of DeGolyer and MacNaughton, who amplified data where desired by the Board or where challenged by other applicants.

Mid-Continent Pipe Lines Ltd. came into the picture rather belatedly and had submissions prepared in a rather brief time by Dr. W. C. Gussow and R. Pot, the former a consulting geologist and the latter of the firm of Trafford and Associates.

Western Pipe Lines engaged David G. Hawthorn of Petroleum Consultants, Houston, Texas, who appeared several times at hearings by the Board.

Both of the latter submissions appeared to accept earlier findings of the



Shell Oil Company of Canada Limited's gas and sulfur recovery plant at Jumping Pound, Alberta, 20 miles from Calgary. On the far left can be seen the heater converters of the sulfur plant. Left center is a boiler house with its five stacks rising in the background. On the right are the processing towers which recover natural gasoline and prepare the natural gas for industrial and domestic use.

A general view of the Turner Valley plant of Royalite Oil Company Ltd. showing the sulfur forms in the foreground and the sulfur plant itself to the right.

Board and then added subsequent discoveries.

Canadian-Montana Pipeline Co. engaged John F. Dodge, who submitted estimates for the most prominent reserves, but did not submit a total for the province. The company he represented was primarily concerned with gas reserves which it owns and which it desired to move to its own distributing lines in Montana.

Northwestern Utilities, serving Edmonton, and Canadian Western, serving Calgary, Lethbridge and intermediate towns, engaged Ralph E. Davis, who submitted estimates for certain fields.

Four other companies also submitted data respecting their own holdings.

The Board estimated "established" reserves as of June 30, 1953 to be 11.5 trillion cubic feet. This compares with DeGolyer and MacNaughton's "proved" reserves as of January 1, 1953 of 11.1 trillion, plus "probable" reserves of 4.4 and "possible" reserves of 3.3 trillion. The difference between their "proved, probable and possible" categories were bound up in the amount of available evidence. They estimated that of the 15.5 trillion in the first two categories, 13.45 trillion will be available for sale.

Gussow and Pot estimated 10.94 trillion "established" as of June 30, 1953. Hawthorn's figure was 10.8 trillion as of January 1, 1953.

The Board looked into the average reserves established per wildcat drilled (regardless of whether it makes a discovery or not) and estimated that on the average, six billion cubic feet has been added to reserves for each wildcat drilled. With incentive supplied for drilling 400 to 500 wildcat wells annually, new reserves of 1¼ to 1½ trillion cubic feet may be expected each year.

The Board appears to have given weight to Mr. Trostel's study in which he estimated the possible productive area in Alberta as 209,570 square miles between the Rocky Mountain Front Range and a line where thickness of sediments is 1,000 feet. He then makes suppositions as to the number of wildcats that will be drilled if a given area is condemned for each dry hole. Then he takes a different area condemned per dry hole and after several such analyses, he suggests using 10 square miles to be condemned on the average. This figure would suggest the ultimate number of exploratory holes will reach 19,000, of which 12,800 will be dry.

From this he projects a minimum of 50 trillion cubic feet will have been discovered, a median of 70 and a maximum of 150 trillion. He suggests that it will require 60 to 70 years to reach ultimate exploration of the province.

Dr. Gussow presented a somewhat similar projection, although perhaps somewhat less detailed in form.

The Board's careful and independent analysis looks to the possibility of an ultimate 20,000 wildcats, of which some 2,300 have already been drilled. Future development of recently drilled gas discoveries is likely to increase reserves to 17 trillion cubic feet without any new discoveries. An additional 1,500 wildcats are likely to increase reserves at a rate of around 7.4 billion cubic feet per well, after which the additional discovery per well will decrease and by the time 20,000 wells have been drilled, discovery will become negligible.

Whether we accept the Board's opinion about trends in growth of reserves, or whether we take those of Mr. Trostel or of Dr. Gussow, it is clear that presently known reserves are only a starting point for consideration of the needs for gas within the province and of the amount that can be sold elsewhere. The Board held to the more modest figure and its recommendation as to quantity to be exported is governed by the reserves now developed, but even the Board looks to the certainty of material reserves yet to be found.

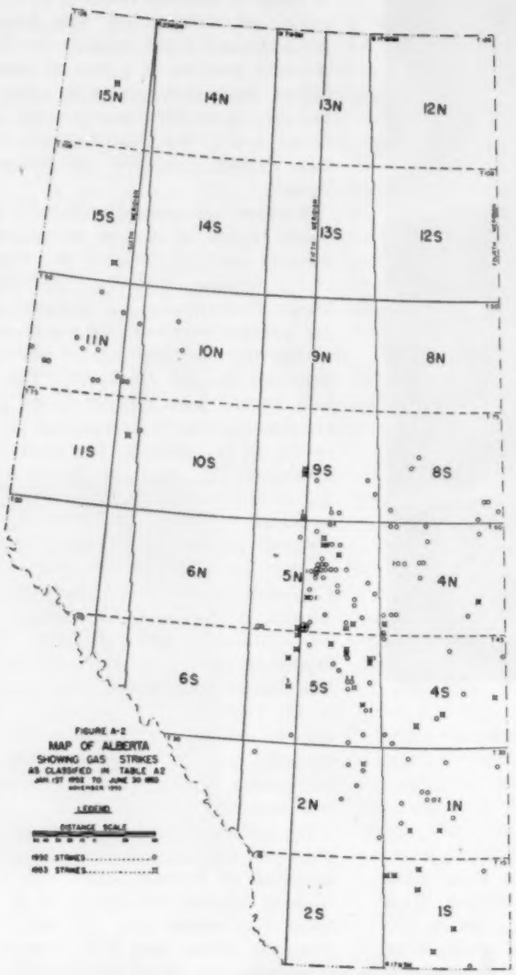
Submission to the Conservation Board by Mr. Trostel in March 1954 indicated a growth in reserves of natural gas in Alberta in the past year of the order of 2½ trillion cubic feet. We reported earlier in this paper that the Conservation Board expects new reserves of 1¼ to 1½ trillion cubic feet will be discovered in drilling 400 to 500 wildcat wells annually, and Mr. Trostel's most recent submission suggests that the expectancy was exceeded last year.

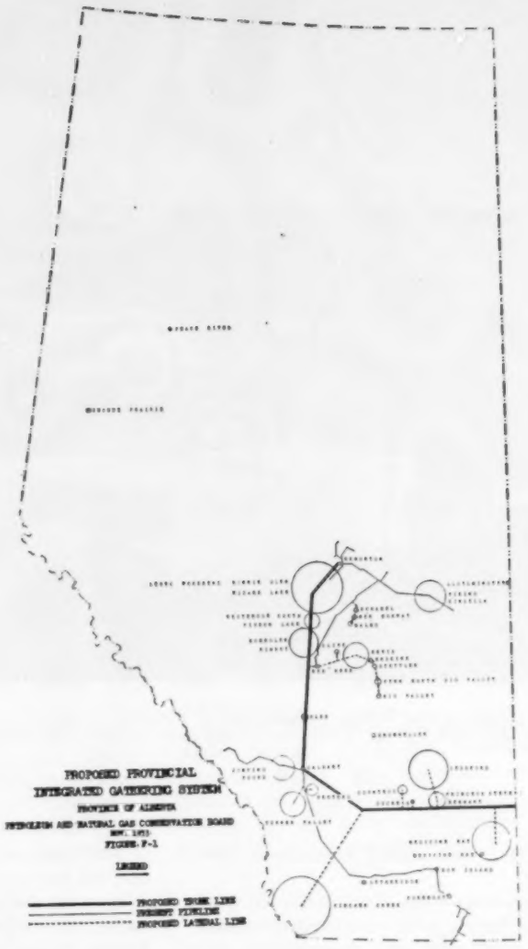
Of particular interest from the standpoint of gas export was Mr. Trostel's appraisal of Provost, which now appears to have around two-thirds of a trillion cubic feet marketable and not too far from the lateral that will be required in gathering gas from the Cessford composite.

A general feeling exists that there is no longer a problem as to exactly how big Alberta's gas reserves are, but the problem may be in building markets rapidly enough. Known reserves are undoubtedly increasing, and in every appraisal there is a lag due to time required to gather data as well as uncertainty as to the meaning of new discoveries in terms of gas in place—an uncertainty that can only be resolved as further exploration and development take place.

We have not quoted evidence given before the Federal Power Commission at Washington respecting the Peace River country, since the data were not available to us. We are aware, however, that continuing exploration has shown continual increases in proven areas adjacent to earlier discoveries, as well as new discoveries that may represent new fields or pools.

The Board estimates requirements for use in the province of Alberta over a 30-year period to the end of 1982 at 4.45 trillion cf, with a peak demand in 1982 of 1,160 million cf/day. To meet the annual and peak day requirements of 1982, it is estimated that reserves of the order of 6.4 trillion cf are needed. In addition,





nearly half a trillion cf will be needed to meet present export commitments to Dawson Creek, B. C., the Pacific Northwest and Canadian Montana.

An analysis of the availability of residue gas from oil fields and of dry gas from fields now connected or near the Northwestern Utilities system which supplies Edmonton shows that the requirements of that system can easily be met.

Reserves now connected to the Canadian Western system supplying Calgary, Lethbridge and points between will meet its full requirements only up to 1956, and further reserves of the order of 1.3 trillion are needed to carry the system for another 30 years, the exact amount being contingent on the characteristics of the reserves.

The Board considered two alternatives in the problem of meeting the deficiency in supplying the Canadian Western system. The Cessford composite group of fields plus Okotoks could meet the need, or the Homeglen composite group of fields could be equally adequate. Since use of Cessford would mean piping gas westward for some distance while Homeglen is close to a number of towns between Red Deer and Calgary not now served with gas, the Homeglen composite is favored. Prospects for finding more gas to the west of a line from Homeglen to Calgary appear to be more favorable than prospects for discoveries tributary to a line from Cessford to Calgary. Furthermore, Canadian Western favors the Homeglen composite as a reserve for Calgary.

Pincher Creek is not a solution for Canadian Western needs owing to the necessity of a high load factor if Pincher Creek is to be operated economically. Pincher Creek gas carries nearly 11 percent hydrogen sulfide, nearly six percent carbon dioxide and about five percent liquefiable hydrocarbons. It is imperative that the sulfur be fixed as gas is drawn, for a release of such large quantities of sulfur either as hydrogen sulfide or sulfur dioxide would be undesirable because of excessive air pollution. For long distance transmission of gas it is equally imperative that liquids be removed to avoid condensate in the line, for liquids in the line would decrease its capacity for gas transmission. Removal of water vapor for long distance piping is a general requirement for gas from all fields and is not peculiar to this one. The total plant requirements are such that capital costs would be too high unless the load factor is to be kept very high. The gas analysis suggests that for delivery of 200,000,000 cubic feet daily to the line, some 1,160 tons of sulfur would be fixed daily and around 12,000 barrels of liquid ranging from propane to heptane would be recovered if all the propane is to be removed. The high load factor needed to make Pincher Creek economic dictates use of residue gas largely for export from the province.

Conveniently placed, Okotoks field would naturally tie in with the Canadian Western system. The Conservation Board studies suggest deliveries to that system of around 9,000,000 cf/day.

The gas contains about 35 percent hydrogen sulfide and Shell (principal operator in the field) has been studying a plan to process about 30,000,000 cf/day of raw gas. Although the fixation of sulfur from H_2S is exothermic, the corrosive nature of the process prevents generation of heat from the reaction in raising steam needed in the plant. Should 30,000,000 cf/day be processed, the plant would yield around 435 tons daily of sulfur and some light hydrocarbons would also be recoverable.

FIGURE A-1
LOCATION AND RELATIVE MAGNITUDE OF THE ESTABLISHED DISPOSABLE RESERVES OF NATURAL GAS
PROVINCE OF ALBERTA
THE PETROLEUM AND NATURAL GAS CONSERVATION BOARD

The Board's scheme for supplying Canadian Western involves an average of some 3.5 million cf/day from Olds, which runs around four percent sulfur, and this would involve fixing an estimated six or seven tons daily of sulfur. One well in the vicinity runs considerably higher in sulfur (reported up to 12 percent), but it may not be in the same reservoir.

Homeglen-Rimbey and Nevis are contemplated as sources of gas for Canadian Western, with Westerose to enter after its oil has been produced. None of these would yield heavy supplies of gas until about 1962, but by 1963 Nevis would reach 14.7 billion cf/year and sustain that rate until 1972, after which the rate would fall. Homeglen-Rimbey would have modest withdrawals from 1957 to 1964, when the rate would increase until a peak of 24.5 billion cf/year would be reached in 1975 and would continue, beginning to drop in 1982, at the end of the period studied. Both of these fields are likely to yield considerable quantities of light liquid fractions, and Nevis contains much sulfur. No very satisfactory analysis of gas from Nevis is available, but from preliminary information, sulfur is expected to be about seven percent.

The Board shows that requirements of Alberta centers in the Peace River country plus commitments to Dawson Creek, B. C. and to West Coast Transmission Co. can be met from presently known reserves with an excess somewhat greater than the commitment to West Coast.

The Board finds that the field around and to the east of the city of Medicine Hat has reserves adequate for local use with an excess of some 230 billion cf that could be exported. This excess would most reasonably be gathered in the part of the field more remote from the city to the east and north.

The province is committed to export 32.3 billion cf between January 1, 1953 and April 6, 1956 from the Pakowki Lake area and finds 321 billion cf surplus to requirements and producible at satisfactory rates of flow up to 1975. They commit 334 billion cf to Canadian Montana Pipe Line Co. over and above present commitments, the difference being involved in problems of deliverability and expected to be produced after 1975.

The Board pointedly declined to consider bringing gas from the Peace River country into a scheme for export eastward on the grounds that distance rules out a transmission line. It is quite apparent, on reading the whole report, that export from Peace River to the west coast is expected, and part of the surplus is committed to that enterprise. Should the Federal Power Commission fail to permit that enterprise to go through, another study would be made. The Board earmarks the Pakowki Lake composite and neighboring fields for Montana. Remaining for export eastward are:

Pincher Creek	2,000	billion cf
Cessford Composite	1,223	" "
Medicine Hat surplus	232	" "
Edmonton deferred composite	25.7	" "
Total	3,480.7	" "

To this they add 153 billion cf to be picked up from a string of fields mostly as casing head gas from oil fields at Clive, Big Valley, Fenn, Stettler, Erskine, Wildunn Creek and others aggregating 50 billion, but each less than 10 billion cf.

From it they deduct 200 billion that would be drawn from the line to supply local demand in the province.

In the report, some 800 billion cf was considered beyond economic reach, but as we write, a review of discoveries and developments that are subsequent to the earlier submissions is being undertaken with the great probability that added reserves will make it economic to gather some of the gas set down in the report as beyond economic reach.

Prominent among the prospects of gas that may become available to Trans Canada is Provost—Hamilton Lake—Watt Lake. Development recently carried out suggests that there is a much larger field than the Board appraised in its report and considered beyond economic reach.

If we were to gather only the gas listed above as available for eastward export, a transmission line from Pincher Creek running to the northeast to meet a southward line from Cessford and then running east with the combined flow of the two lines to pass through the northern end of the Medicine Hat field would miss collecting only an inconsiderable part of the gas available for eastward movement. The Board has produced the accompanying map showing a proposed trunk line, proposed lateral gathering lines and existing lines.

The proposed trunk line starts at Edmonton, heads southwest to Leduc field,

(Continued on page 175)

Theo A. Link

Dr. Link and Mr. Downing are no strangers to readers of WORLD PETROLEUM. *Last year they contributed a study of Western Canada oil reserves which appeared in the May and June issues, of which the present article is a continuation. Dr. Link is president and Mr. Downing vice president of Link, Downing and Cooke Ltd., consulting geologists, Calgary. Dr. Link was formerly chief geologist for Imperial Oil Ltd. Mr. Downing resigned as geologist for Pacific Petroleums Ltd. in 1950 to become associated with Dr. Link. Both authors have been intimately associated with the Western Canadian fields throughout their period of development.*

John A. Downing

Oil reserves of Alberta

By Theo. A. Link and John A. Downing

DURING THE YEAR 1953, the recoverable oil reserves in Alberta increased by 1,589 million barrels, bringing the total oil reserve of Alberta to 3,324,400,000 barrels (including natural gas liquids). The major part of this more than one third increase is due to the discovery of the large Pembina oil field which has indicated reserves of over one billion barrels. The remainder of the increase in the oil reserves is due mainly to areal extensions of fields discovered in 1952 and to the large increase in the natural gas liquid present in fields discovered in 1953.

It appears that the year 1953 was the most important for the oil industry in Alberta and in Western Canada since the discovery of Leduc in 1947. This is because commercial crude oil was discovered in the Cardium, an Upper Cretaceous sand in the Pembina area west of Edmonton. If the Cardium sandstone proves productive over what appears to be a continuous oil saturated sheet of sandstone in the Pembina field, the areal extent of the field would exceed that of the East Texas field by a wide margin and the reserves therein would be the largest single crude oil reserve in Western Canada. In addition, the Sturgeon Lake discovery, to which last year was credited some five million barrels of oil, now has all the earmarks of developing into a major field or several pools, with reserves totalling more than 100 million barrels. Added to all this are the numerous minor gas and oil field discoveries and the markedly increased reserves for previously discovered fields by stepouts for the coalescence of what before 1953 looked like separate pools.

The recoverable oil reserves of all fields in Alberta increased by some 1,452 million barrels of oil in 1953. This figure includes 1,193 million barrels assigned to the Pembina field. During 1953, production amounted to 76,818,000 barrels of crude from 4,504 producing wells, and in that same period 6,422,889 feet of development and exploratory drilling was completed. In addition, the recoverable natural gas liquids increased by more than 100 million barrels.

The total present recoverable oil reserves and natural gas liquids are estimated to be 3,320,400,000 barrels. These are present in the following types of fields:

THOUSANDS OF BARRELS

Magnitude of Field	*Recoverable Reserves*
8 Major (100 million bbls. or more)	2,754,600
Intermediate (20 million to 100 million bbls.)	212,700
Minor (less than 20 million bbls.)	155,000
Total Crude	3,122,300
Natural Gas Liquids	198,100
Total Liquid	3,320,400

To date 12 oil fields in Alberta, all of which have been discovered since 1947, account for the major part of the recoverable crude oil reserves in Western Canada. Eight of these are major fields with original recoverable reserves of 100 million barrels or more. A resume of these fields, showing the productive horizon, the estimated original recoverable oil, the cumulative production to the end of 1953, and the estimated remaining reserves is shown in Table I (page 104).

Pembina

The most significant discovery in 1953 was made by Socony-Vacuum Exploration Co. in the Pembina area which lies 60

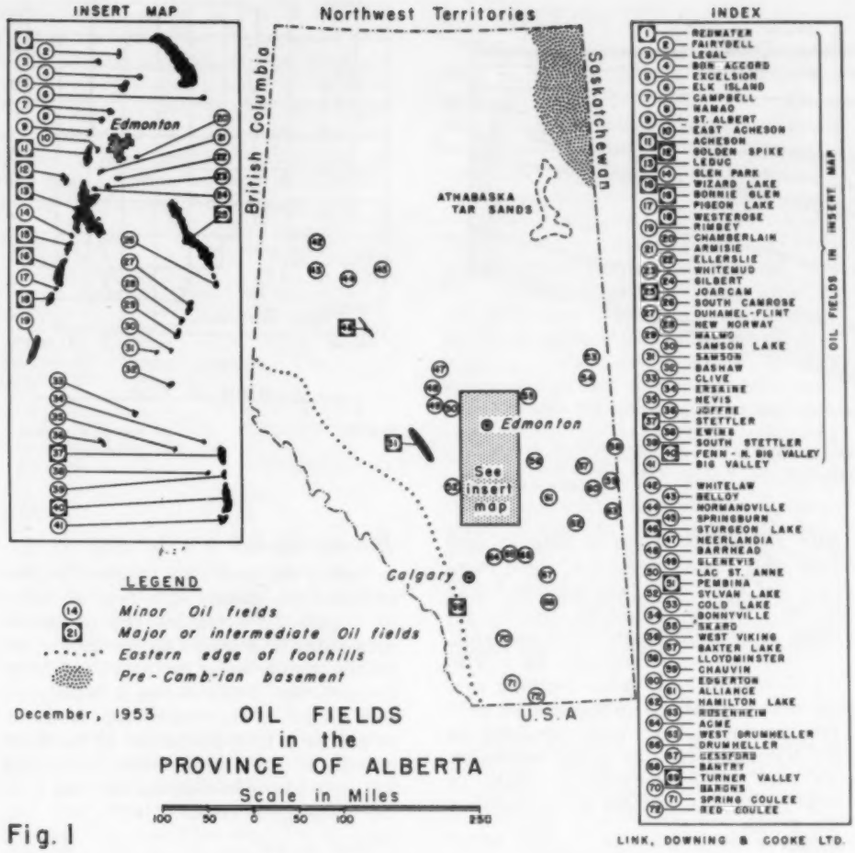


Fig. 1

miles southwest of Edmonton, Alberta. The principal oil reservoir is the Cardium formation of Upper Cretaceous age which, in the developed area, lies at depths from 4,800 to 5,300 feet. In addition to the Cardium, the Belly River sands (Upper Cretaceous), the Viking sand, and the Basal Lower-Cretaceous sands as well as the Madison formation (Mississippian) have been indicated as oil and/or gas reservoirs in the Pembina area.

The distribution of the Cardium sandstone is restricted to the western part of the Province of Alberta and the eastern part of northeastern British Columbia. It outcrops throughout the foothills belt of Alberta and British Columbia, and in the plains region of the Peace River area of Alberta where it has been called the Bad Heart formation. East of the foothills belt, in the plains area, the Cardium thins until it is represented by only a thin pebble bed. The sub-surface eastern edge of the porous Cardium sandstone appears to trend north from the Pincher Creek area in the southern part of Alberta, passing slightly east of the Turner Valley field, and from there it pinches out along an irregular line running in a north-northwest direction. There may also be separate lenses of porous sandstones east of this main pinchout of porous Cardium sandstone. The regional dip of all the sediments in this area is to the west and southwest and the east and northeastward facies change from a porous sand to a shale, thus forming an up-dip stratigraphic trap. Figure 2a is a generalized schematic cross-section showing a part of the sedimentary sequences including the Belly River standstones and shales, the Cardium sandstone with the underlying and overlying marine shales, Viking and Blairmore sandstones, and the Madison formation as developed in the Pembina area. The possible areal extent of the Pembina area Cardium sand pool is indicated in Figure 2.

In the Pembina field area the Cardium formation comprises 60 to 80 feet of hard, very fine-grained sandstones and shales, which grade laterally into the predominantly shale facies eastwardly. Twenty wells have been either completed as oil wells in the Cardium or have indicated commercial production. These wells are scattered over a wide area, yet no flank oil-water interface has been encountered to date. The oil column extends from a high of —1,815 subsea to —2,450 subsea, a total of 635 feet. As already stated, the field is limited to the east and southeast by the pinchout of porous sand. The west, southwest, and northwest limits have not been found. What to date appears to be a continuous sheet sand saturated with oil, is now 54 miles long with an indicated maximum width of 16 miles. This is an area of roughly 340,000 acres, but because of the possible variation of porosity and permeability within the sand body, and the probable variation in the pinchout boundary, it cannot be regarded as all proven acreage at this time. However, should all the above outlined area prove to be productive, it would exceed the large East Texas field in area by a large margin.

Very little is known of the reservoir characteristics of the Cardium, but information released to date indicates an oil recovery of approximately 3,500 barrels per acre. This is based on the following factors, some of which have been released by the Petroleum and Natural Gas Conservation Board of Alberta:

Estimated average effective pay	17.5 feet
Estimated average porosity	15 percent
Estimated connate water— (% of pore space)	30 percent
Shrinkage factor	0.82
Oil in place per acre	11,700 bbls. (approx.)
Estimated recovery	30 percent
Recoverable oil per acre	3,500 bbls. (approx.)

Using the figure of 3,500 barrels of oil per acre, the field has a recoverable reserve of 1,193 million barrels, and comprises more than one third of Alberta's total recoverable reserves as of this date.

Production to December 31, 1953 has amounted to only 40,000 barrels, mainly from Socony Pembina No. 1, the discovery well, which, during six month's production, produced 22,000 barrels. The

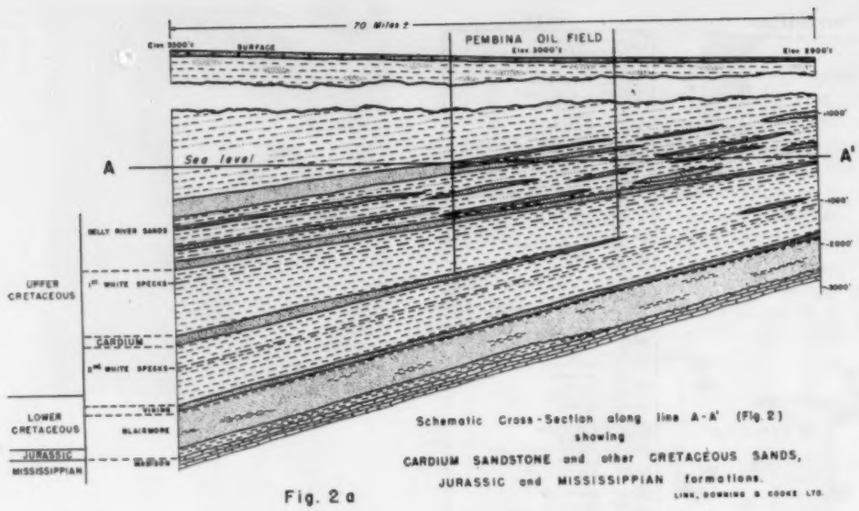


Fig. 2a

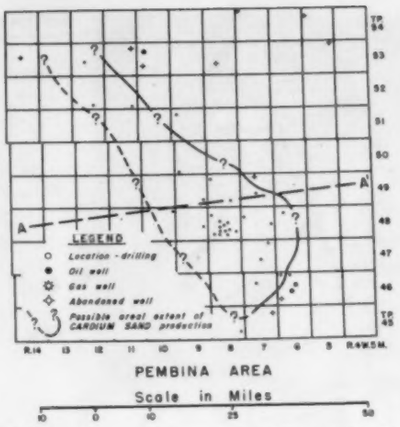


Fig. 2

gas/oil ratio during these six months of production averaged 340 cubic feet per barrel of oil and the gravity of the crude averages 37° API. The initial production tests vary between 82 and 456 barrels per day through ¼-inch choke. By the end of February 1954, 17 wells were ready for production. The well spacing set by the P. and N. G. Conservation Board is 80 acres, and the maximum producing rate is set at 200 barrels per well for the present time. The prorated allowable is in part subject to market demands and is expected to vary with demand. Various estimates of future production have been made by several consultants and oil companies for presentation to the P. and N. G. Conservation Board of Alberta in connection with the building of a pipe line, and these have varied from 75,000 barrels per day in 1956 to 132,000 barrels per day by 1960.

As previously mentioned, the Belly River sands, the Viking and Lower Cretaceous sands, and the Madison carbonates are known to be oil and/or gas reservoirs in the Pembina area. Some wells have yielded oil or gas or both on drill stem tests in one or more of these members, but these have been completed only in the Cardium formation. In the extreme southeastern part of the map area, one well has been completed as a Viking oil well, and one in the northern part has been completed as a Madison oil well. Two gas wells have been completed in the Madison formation in the southeastern part. The approximate depths to these productive horizons are as follows:

Age & Formation or Member	Depth	Remarks
Upper Cretaceous		
Belly River	3300-4330	Several sand members. Oil & gas shows on drill stem tests.
Cardium	5200+	Main oil productive horizon.
Lower Cretaceous		
Viking	6200+	Oil in DST's & one potential oil well.
Basal Sands (Ellerslie)	6900+	Oil and gas on DST's.
Mississippian		
Madison	7100+	Gas and oil on DST's and one producing well.

Bonnie Glen

During the year 1953, step-out drilling extended the Bonnie Glen field as shown in Figure 3, increasing the productive area of the field from 3,600 to 5,600 acres. Information released by the P. and N. G. Conservation Board shows a total pressure decline in the field of approximately 45 psi for a total production of 6,294,000 barrels of stock tank crude. The estimated recoverable reserves are based on the following reservoir data:

Average oil pay	228 feet
Average porosity	9.5 percent
Shrinkage factor	0.664
Connate water (% of pore volume)	13 percent
Oil in place per acre/ft.	426 barrels
Estimated recovery	50 percent
Recoverable oil per acre/ft.	213 barrels
Total recoverable oil	272,000,000 barrels
Less Production to January 1, 1954	6,300,000 barrels
Remaining recoverable reserves	265,700,000 barrels

Westerose

The Westerose field (previously called Fiveland) was discovered in September 1952 and has been developed during 1953

TABLE I
RESERVES OF MAJOR FIELDS IN ALBERTA

Field or Pool	Producing Formation	Original Recoverable Reserves (Thousands of Barrels)	Cumulative Production to Jan. 1, 1954 (Thousands of Barrels)	Remaining Recoverable Reserves (Thousands of Barrels)
Pembina	Cardium	1,193,000***	negligible	1,193,000
Redwater	Leduc**	690,000	86,000	604,000
Bonnie Glen	Leduc**	272,000	6,300	265,700
Leduc	Nisku***	69,000	25,500	43,500
	Leduc**	208,000	51,500	156,500
Wizard Lake	Leduc**	154,000	5,000	149,000
Sturgeon Lake	Leduc**	135,000	negligible	135,000
Fenn-N. Big Valley	Nisku***	112,000	2,800	109,200
Golden Spike	Leduc**	103,000	4,300	98,700
Joarcam	Viking	80,000	7,800	72,200
Acheson	Leduc**	63,000	5,200	57,800
Westerose	Leduc**	60,000	1,000	59,000
Stettler	Nisku**	25,000	1,300	23,700
				2,967,300

*—Canadian Petroleum Association.
**—Formerly termed the D-3 of Upper Devonian.
***—Formerly termed the D-2 of Upper Devonian.
****—Does not include estimates for possible Belly River, Viking or Madison reserves.

TABLE II
SUMMARY OF MINOR POOLS DISCOVERED IN 1953

Pool or Field	Discovered	Reservoir	Average Thickness of Pay (Feet)	Depth (Feet)	Initial Production b/d	Order of Recoverable Reserves (Barrels)
Acme	July	Leduc		7,200	68	200,000
Baxter Lake	February	Low. Cret.* .	10	1,900		200,000
Battle	January	Viking	10	3,250	89	500,000
Cold Lake	March	Low. Cret.* .	10	1,100		200,000
Elk Island	April	Low. Cret.* .	5	3,350		300,000
Ewing	January	D-3	15	5,500	80	200,000
Fairydell	February	D-2	25	3,750		4,000,000
		D-3	30	4,000	240	5,000,000
Grassy Lake	February	Jurassic	10	3,100	50	300,000
Joffre	September	Viking	12	4,900	147	5,000,000**
Samson	April	Low. Cret.* .	15	4,900		2,000,000
Samson Lake	February	D-3	20	5,400	1,500	500,000
Springburn	February	Beaverhill L. .	10	6,900	200	500,000**
Sylvan	November	Viking	10	6,200	456	200,000**
Acheson (East)	October	Low. Cret.* .	15	4,150	240	2,000,000
						21,100,000

*—All produce from basal (Ellerslie) Lower Cretaceous sands except Baxter Lake and Cold Lake.
**—Could be larger or much larger.

to the extent shown in Figure 2. Well spacing has been set at 80 acres per well by the Conservation Board, and there are currently 16 producing wells in the field. The ultimate productive area of the pool is estimated to be 1,920 acres, and the calculated total recoverable reserves on that basis are 60 million barrels. The following are the reservoir factors:

Average oil pay	178 feet
Average porosity	8.55 percent
Shrinkage factor	0.695
Connate water (% of pore volume)	15 percent
Oil in place per acre/ft.	392 barrels
Estimated recovery	45 percent
Recoverable oil per acre/ft.	176 barrels
Original recoverable oil (estimated)	60,000,000 barrels
Less production to January 1, 1954	1,000,000 barrels
Remaining recoverable reserves	59,000,000 barrels

Rimbey

The Rimbey field was discovered in January 1953 by the California Standard Co., and subsequent development drilling has indicated that this field has a relatively large areal extent. The oil column is approximately 25 feet in thickness and is overlain by a gas column up to 400 feet in thickness. However, insufficient data on this field are available to allow a reasonable estimate of oil reserves. Twelve wells have been completed in the area, but only four have produced any appreciable quantities of oil. This field has a large natural gas liquids reserve.

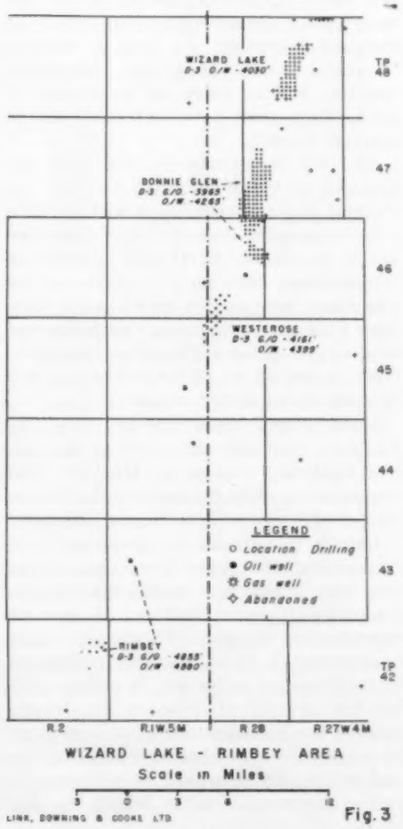


Fig. 3

Sturgeon Lake

The Sturgeon Lake pool or pools are located on the up-dip edge of a large biostromal reef deposit in the Peace River area of Alberta. The discovery was made in August 1952 by Amerada Petroleum Corp., and since that time 15 follow-up wells have been drilled, of which seven are capable of producing oil from the reef deposit. The distance between the most northerly and most southerly oil wells is now 20 miles. However, all the intervening area cannot, as of this date, be regarded as proven. The only indication of width is at the northern end where it is approximately one mile wide. The maximum oil pay is approximately 180 feet, and the average depth of the producing horizon varies from 8,400 to 8,800 feet.

With the present information available to the writers, no estimate of the recoverable oil reserves can be calculated. However, there is little doubt that a major pool or its equivalent is present in this area, and present data indicate the field has a recoverable reserve of some 135 million barrels of light gravity crude.

Fenn-North Big Valley

During the year 1953 the two pools at Fenn and North Big Valley have been joined by development wells. During this coming year Big Valley and North Big Valley will probably experience a similar coalescence. The recoverable reserves of the Fenn-North Big Valley field have increased considerably, and it can now be classified as a major oil field. The original recoverable reserves are estimated to be 112 million barrels, based on the following reservoir data:

Producing Horizon	Nisku (D-2)
Estimated productive area	9,280 acres
Average pay thickness	64 feet
Average porosity	8.9 percent
Connate water (% of pore volume)	15 percent
Shrinkage factor	0.80
Estimated recovery	40 percent
Estimated recoverable oil	112,000,000 barrels
Less production to January 1, 1954	2,800,000 barrels
Remaining recoverable reserves	109,200,000 barrels

Minor Pools

Table II is a summary of pools of minor importance discovered during the year 1953. The total reserve of these is estimated to be approximately 21 million barrels. However, subsequent development by step-outs could enlarge some of these into sizable or even major pools.

During the year 1953, oil and gas were discovered in four formations or members of the sedimentary sequence in Alberta which had not previously been productive. These were Upper and Middle Devonian carbonates and the Upper Cretaceous Cardium and Belly River sandstones, the last of which has been discussed in the section on the Pembina field. Prior to

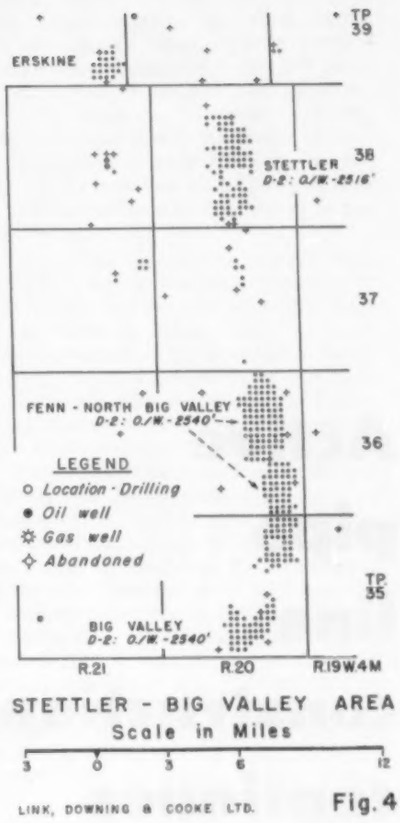


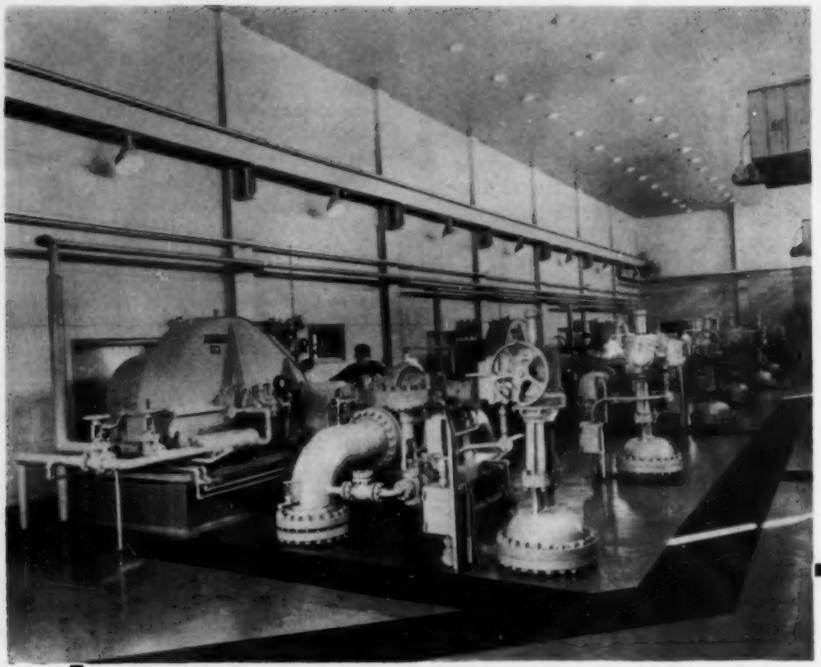
Fig. 4

1953, small amounts of oil and gas were encountered in these two formations, but they had not been considered too highly as potential oil reservoirs by the greater part of the oil industry.

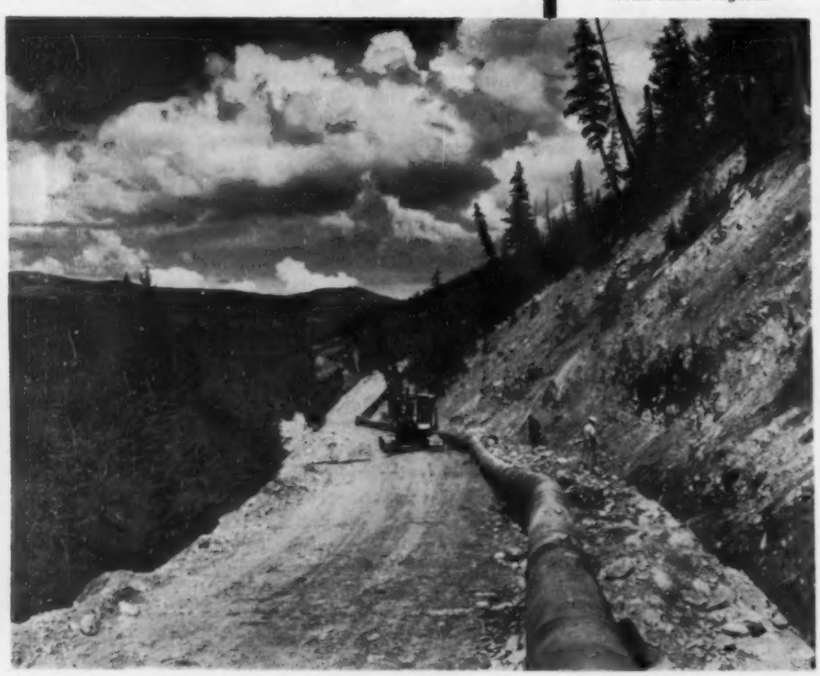
The two significant Devonian discoveries were Shell Imperial Springburn No. 1 and California Standard Steen River No. 2-22. The former, in the eastern part of the Peace River area, discovered an oil pool in the carbonate unit underlying the Woodbend formation (which includes the Leduc reefal member when present). California Steen River No. 2-22, some 200 miles north of Peace River town, and 60 miles south of the North West Territories-Alberta border, encountered varying flows of natural gas (up to 4,000 Mcf/d) in two rock units. The age of these two rock units is questionable, but they may be Upper or Middle Devonian or both. They have been correlated with the Presqu'ile Dolomite, a reef deposit of Middle Devonian age which outcrops on the shores of Great Slave lake.

These two discoveries, while perhaps not representing large accumulations of hydrocarbons, do indicate that older Devonian sediments are productive when the necessary stratigraphic or structural conditions are present. They add considerable hope for eventual discovery of large oil fields in the immense unexplored area of Northern Alberta, northeastern British Columbia and the North West Territories.

Active pipe line construction continues in Canada



Three 1,760 hp diesel engines installed at an Interprovincial station. One entirely new pump station is to be built this year and eight others doubled in capacity.



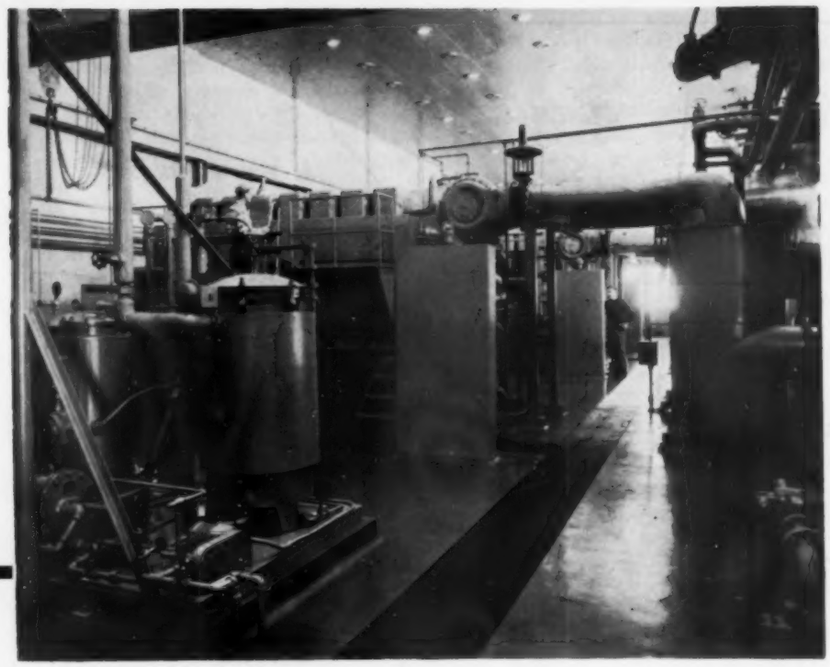
The Trans Mountain Oil Pipeline was completed across the Rocky Mountains in 1953 to deliver Prairie crude to Pacific Coast plants. Photo by Richard Finnie for Bechtel Corp. in the Yellowhead Lake region.

NEW CANADIAN PIPE LINE construction in 1954 will represent an investment of about $80 million. This estimate of the cost of new lines undertaken this year does not include either of the two major gas lines which are projected for early construction. As this is written, it seems likely that no substantial progress will be made on these lines in 1954. Next year both are likely to be marked "rush."

As this is written it has been announced at Washington, D. C., that the Federal Power Commission will expedite a decision on the importation of Canadian gas to the Pacific Northwest by omitting intermediate decision procedure. Action was taken because 200 days already have been consumed in hearings between contending U. S. and Canadian interests. Over 28,000 pages of testimony and 600 exhibits have been presented.

Main briefs were ordered filed by April 26, staff counsel briefs by May 11, and applicant replies by May 26. Oral argument is to begin on June 1. Clearly no construction will be begun this year.

Details involved in planning and financing the proposed Trans Canada gas line system also will be too many to be completed in time for the initiation of construction in 1954. First steps have been taken by Union Gas Co. in Ontario to build up a gas market in preparation for the arrival of western gas. Steps involve the construction of a system of lines to serve a number of Ontario cities and towns. These would be temporarily served by nearby fields which do not



Pump room at the Superior station of Interprovincial's Lakehead extension. This, like other Interprovincial stations, is to be enlarged this year.

have reserves for a long period of service.

The gas line program in 1955 is likely to be even greater than the oil line construction in 1952 and 1953, when Canadian mileage was more than doubled. The following tabulation shows the remarkable growth of the Dominion's system in recent years.

YEAR	MILEAGE AT END OF YEAR
1947	435
1948	455
1950	1,659
1951	1,751
1952	2,870
1953	3,924

Trunk line mileage now totals about 3,309 miles, and about 624 miles of spur and gathering lines are in service.

Six major trunk lines are included in the Canadian system. Of these, three are engaged in crude transportation and three handle products. The three crude lines of major importance are the 718-mile Trans Mountain Oil Pipe Line, the 1,772-mile Interprovincial system and the 236-mile Portland-Montreal system. The three products lines primarily built to supply the Toronto area are the 442-mile Trans Northern, originating in Montreal, and the 195-mile Sarnia Products and 195-mile Sun Canadian lines which parallel each other and originate in Sarnia.

The three product lines currently are able to deliver 110,500 b/d of refined products into the Hamilton-Toronto-Ottawa market. Each is capable of greatly expanded delivery with the addition of new pumping capacity. One such expansion is now being undertaken.

Main line capacity of the three principal crude carriers currently totals 489,000 b/d. Of this, 158,000 barrels of capacity is devoted to the movement of foreign crude to Canadian plants and 331,000 b/d is available for transportation of Canadian oil to market. This year will see the enlargement of capacity to import foreign oil and to move Prairie crude eastward to Sarnia.

Canada's 624-mile spur and gathering line system is in a state of constant expansion as new fields are being discovered. At the moment, proposed major additions to the system include facilities for gathering and delivering Pembina crude to trunk lines in Alberta and similar lines to provide an outlet for Saskatchewan's commercially proven fields such as the Fosterton area and Smiley.

Most costly project this year has been undertaken by Interprovincial Pipe Line Co. to increase delivery capacity at Sarnia. Interprovincial has earmarked $50 to $60 million for new pump stations and looping. Last year Interprovincial spent $12 million for looping to increase delivery capacity at Superior.

When the Interprovincial line first was laid from Edmonton to the head of the Great Lakes at Superior in 1950, it was not visualized that discoveries in western Canada would approximate what has been achieved. Western sections of the line consisted of 20 and 18-inch pipe as far as Saskatchewan refineries and thence eastward the line was 16-inch. In 1951 Interprovincial delivered 35,500 b/d of crude at Superior. With production rising, the company looped 100 miles of line and built five new pump stations to bring Superior deliveries to 58,621 b/d. Last year it was necessary to continue the looping program by laying 135 miles of 24-inch loop east of Regina and to install additional horsepower at pumping stations.

The growing potential of western fields in 1953 justified also the extension of the Interprovincial line from the head of the lakes to Sarnia, Ont., for year-around delivery of crude to that refining center. The 643-mile extension was built with 30-inch pipe to provide for future expansion to 300,000 b/d if necessary. Cost of the project was $74 million.

The Sarnia (Lakehead Pipe Line) extension was built across the state of Wisconsin and Michigan to reduce mileage. Technical aspects of the crossing of the Straits of Mackinac from the upper to the lower peninsulas of Michigan are described eleswhere in this issue.

At the close of 1953 the Interprovincial system had a capacity of 171,000 b/d east from Edmonton and 126,000 b/d at Superior. Deliveries to Sarnia were slightly below 100,000 b/d when the Lakehead extension was complete.

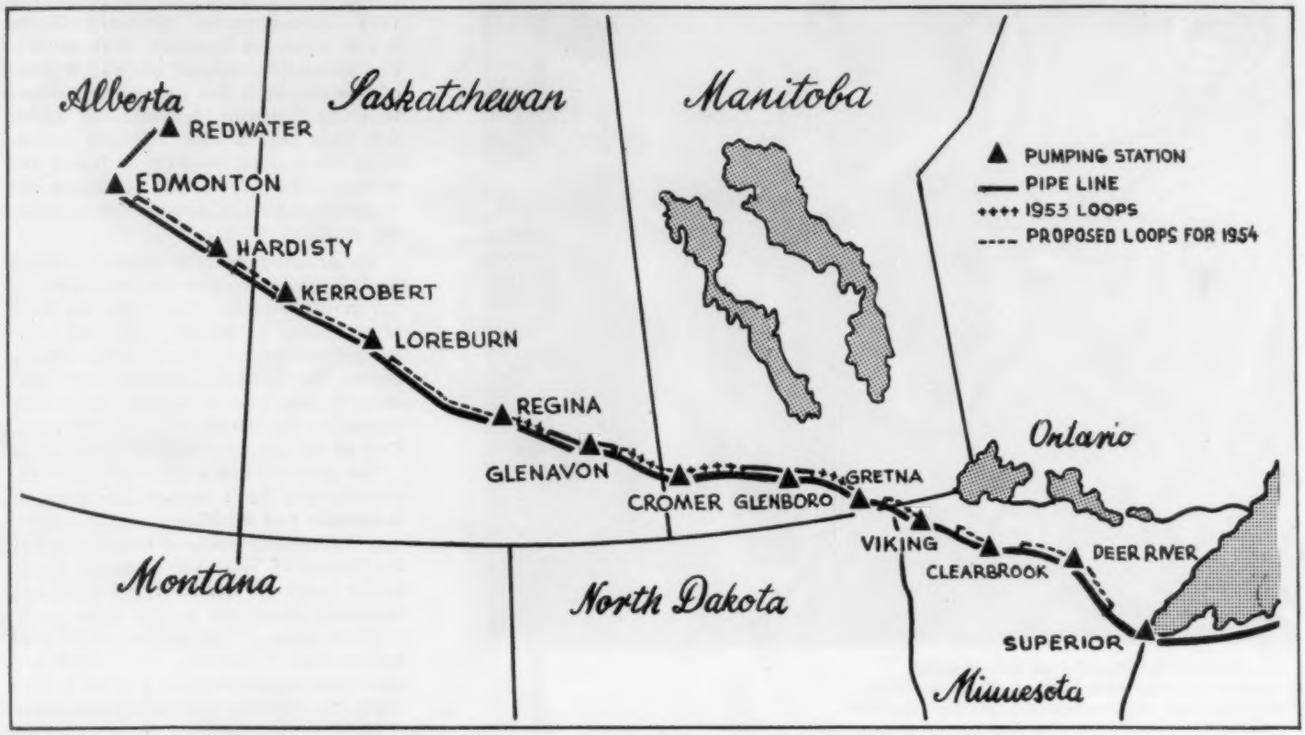
Interprovincial received 54.2 million barrels into its system in 1953, of which three million barrels was required for new line fill. In 1952 the line received 41.8 million barrels. Deliveries to Edmonton refineries rose 300,000 barrels in 1953 to 2.7 million barrels. Other Prairie refineries increased their take by 3.1 million to 20.4 million barrels. Superior refineries took 1.5 million barrels more oil, increasing to 2.5 million. Tanker loadings increased from 19.9 to 23 million barrels.

Interprovincial reduced its tariff last year because of the increased business, but was able to increase its net earnings $325,811 to $4,443,500. Net per share in 1953 was 88 cents. The Sarnia extension did not begin deliveries until January 1954 and hence provided no revenue last year.

The 1954 construction program, consisting of 600 miles of new loop plus the building of nine pump stations, will raise capacity of the system to 205,000 b/d from Edmonton to Regina, 170,000 b/d from Regina to Cromer, 175,000 b/d from Cromer to Gretna, 159,000 b/d from Gretna to Superior, and 138,000 b/d from Superior to Sarnia. Over-all increase in capacity this year will be on the order of 40,000 b/d.

Loop to be laid this year consists of 454 miles of 24-inch and 184 miles of 26 inch, the latter to be on the Minnesota side of the border. Contracts for the work have been let.

Pump station construction program consists of the doubling of horsepower at eight stations and the erection of one



Map showing construction work planned by Interprovincial for completion this year.

entirely new station at Saxon, Wisc. on the Lakehead 30-inch extension. The eight stations to be doubled in capacity are at Regina and Glenavon in Saskatchewan; Cromer, Glenboro and Gretna in Manitoba; and Viking, Clearbrook and Deer River in Minnesota. A typical station will consist of three eight-cylinder 1,760 hp diesel engines connected in series to three centrifugal pumps. Two engines are planned for normal operations with the third in stand-by service.

A group of accompanying photographs illustrate the Superior, Wis., pump station which is to be duplicated at Saxon. The station was designed by Bechtel Corp. and built by Walco Engineering and Construction Co. of Tulsa. An interesting feature is the raft-type floating base used because pile supported footings would not have been satisfactory in the soil at Superior. There are two structures, a 24 x 86-foot manifold building and a 76 x 184-foot main building housing the three 1,760 hp diesels driving three 5,000 gpm booster pumps. The station has a capacity of 120,000 b/d.

The Lakehead extension began operations at the rate of 88,000 b/d serving the Canadian Oil Companies Ltd. 20,000-barrel plant and the Imperial Oil Ltd. 71,500 b/d refinery at Sarnia. British-American Oil Co. still is lifting crude by tanker for its 17,000 b/d Clarkson plant. This is more economical than trans-shipping at Sarnia for a very short lake haul.

An extension of 195 miles to Clarkson and Port Credit would enable Interprovincial to serve an additional present refinery capacity of 23,500 b/d at the Trinidad Leaseholds and B-A plants. It has been said that owners of both plants probably would enlarge their still capacity if pipe line crude were available.

Assuming that oil discoveries continue at their recent rate and potential production on the Prairies begins to approximate Canadian demand, it seems likely that there will be much pressure exerted by western crude seeking a market in Montreal. To deliver oil to the 175,000 b/d Montreal refinery market, an added extension beyond Toronto of 440 miles would be necessary before western crude could compete with oil imported from the Caribbean by tanker and the Portland-Montreal pipe line. Entry into the Montreal market also would require Interprovincial to redesign its system from Edmonton to Superior and add four new stations on the Lakehead extension. A major investment would be required to pump enough oil to supply Montreal plants some 2,400 miles from Edmonton. Opening of this market is not visualized in the immediate future, but the economics are not bad on the basis of today's crude markets in the Middle East and Latin America plus reasonable ocean freight.

Some market for Western Canada crude is expected to develop in Minnesota and Michigan in spite of present U. S. import duties.

Great Northern Oil Co. is beginning the construction of a 20,000 b/d refinery at St. Paul, Minn., for which a long-term Canadian crude supply has been obligated by Socony-Vacuum Oil Co. and Woodley Petroleum Co. Saskatchewan crude probably will be delivered. As this is written it is not clear just what route will be followed. Until recently it had been assured that the Sioux big-inch system proposed by Shell and other large U. S. companies operating in the Williston Basin would be built from North Dakota to Chicago by way of the Twin Cities and that southern Saskatchewan oil would be delivered to this system by a spur line. About the middle of March an official of one company was quoted as saying that a 150-mile lateral would be laid from the Fosterton area to connect with Interprovincial. Other factors in the Sioux system have been unwilling to confirm this, however.

Delivery of Fosterton crude is complicated by its high viscosity. It may require mixing with a light oil such as that from Smiley to make it acceptable by Interprovincial.

Last October saw the completion of the 718-mile, 24-inch Trans Mountain Pipe Line across the Rocky Mountains at a cost of $93 million to deliver Prairie crude to refineries on the Pacific Coast. The line has an initial capacity of 120,000 b/d which can be expanded to more than 300,000 b/d when coastal demand warrants the installation of more pumping stations.

When the line first was planned, it was assumed that Canadian crude would find a market in California refineries, particularly those in the San Francisco

Bay area. At that time fairly large quantities of Middle East and Sumatra oil were being imported into California to supplement deficient local supplies of light oil. A drop in ocean freight rates from the Persian Gulf has equalized the cost of Middle East crude with that of Alberta crude at Vancouver so that it cannot now be loaded into tankers and transhipped to San Francisco. A raise in ocean freights or a cut in the $2.65 price of Alberta crude plus a drop in Trans Mountain tariffs based on increased throughput could possibly change the situation and permit coastwise shipment to California. Opening of this trade is not now contemplated, however. At present the cost of Alberta crude loaded into tankers at Vancouver is $3.125 per barrel. This could be reduced to $2.925 if volume through Trans Mountain should rise to 200,000 b/d, permitting a reduction in tariff from 45 to 25 cents per barrel. Current delivered cost of Persian Gulf crude on the Pacific Coast is about $3.11.

Capacity of British Columbia refineries served by Trans Mountain now is 50,850 b/d. Another 11,000 barrels of capacity will go on stream late this year when Standard of California's new Burnaby plant is activated. British American has cleared a site, but has not announced active building plans.

Also late this year a new market for Canadian oil across the border in Washington will be available. General Petroleum Corp. is building a 28,000-barrel plant and Shell Oil Co. has announced that it will build a 50,000 b/d plant at Anacortes, Washington. Completion of new plants now under way on both sides of the border will give an outlet for about 130,000 barrels of Alberta crude before the end of 1955.

To enable the delivery of Alberta crude oil this fall to General Petroleum's new Ferndale refinery and to prepare for similar deliveries next year to Shell, Trans Mountain has timed its Washington construction program to start off May 1 of this year with a completion date for this season set at September 15.

The estimated cost of the 1954 construction is over $2 million. Bids for the construction contracts were called for during March. An administration office has been opened in Bellingham under the management of E. L. Guard.

The U. S. line will receive the oil from a 24-inch spur line of its Canadian affiliate at the international boundary just east of Sumas, Wash. A scraper trap will be installed on the Canadian side of the boundary, where the 20-inch line will originate. The 20-inch line will extend for 15.3 miles in a southwesterly direction through well-settled mixed farming country to a junction near Laurel whence a 16-inch line will extend for 11.3 miles due west to the General Petroleum refinery.

The 20-inch line will cross the small Sumas River several times, and will cross the large Nooksack River once near Everson. The 16-inch line also will cross the Nooksack River just south of the town of Ferndale.

Scheduled for 1955 construction, the 20-inch line will be extended southward from Laurel Junction for a distance of 27 miles to another junction point just west of Mt. Vernon, Wash. whence a 16-inch line will be extended 10 miles westward to the Shell refinery. March's Point, its site, lies between Fidalgo and Padilla Bays. The installation at the junction point near Mr. Vernon will be generally similar to that at Laurel except that the need for a future pump station is not foreseen.

Discovery and rapid development of the new Pembina field 75 miles southwest of Edmonton has created the need for a new gathering system and a spur to make deliveries to either the Trans Mountain or Interprovincial systems. On March 9, the Alberta Petroleum and Natural Gas Conservation Board started hearings on three applications for a permit to construct such a system.

The applicants were Socony-Vacuum Exploration Co., Baysel Pipe Lines (a subsidiary of Bailey Selburn Co.), and Pembina Pipeline Co. Ltd. The three routes proposed are all different. Socony proposed a 30-mile, 16-inch line, from Drayton Valley north to Gainford on the Trans Mountain Pipe Line. The line to Gainford would have a capacity of 88,000 b/d, to be increased to 132,000 barrels after construction of another line to Edmonton which would carry 50,000 b/d for eastern markets, with 82,000 barrels to go to the Pacific Coast. Total cost would be $18,910,000.

The Baysel main line would start near the town of Pembina, extend southeast to Minnehik, northeast to Calmar, and then to Edmonton for entry into the Trans Mountain and Interprovincial lines. Length of the 16-inch line would be 85 miles.

The Pembina Pipeline Co. proposes a line from Drayton Valley to Gainford, and then to Edmonton. The route would be approximately the same as that proposed by Socony, but consisting of 16-inch all the way, instead of a 12-inch line from Gainford to Edmonton. The line would be 72 miles long, and would cost $13,816,000. All Pembina production would be delivered to Edmonton for shipment either to the Pacific Coast or to eastern markets.

Last year capacity of the Portland-Montreal pipe line system was increased 8,000 b/d to 158,000 by reactivating one of the Montreal Pipe Line Co. Limited's original stations on the 12-inch line to give four stations instead of three. One pump unit was added to each station.

With Imperial increasing the capacity to its Montreal plant by 25 percent and with Canadian Petrofina building a new 20,000-barrel refinery, it again becomes necessary for the Portland system to be enlarged. This year capacity will be increased to 190,000 b/d by the construction of four new intermediate stations to give eight-station operation on the 18-inch line between South Portland, Maine and Montreal East, Quebec. No change is contemplated on the 12-inch line, which will continue with 4-station operation. Portland Pipe Line Corp. will own and operate three of the new stations which will be built at Raymond, Maine, Gorham, New Hampshire and Sutton, Vermont.

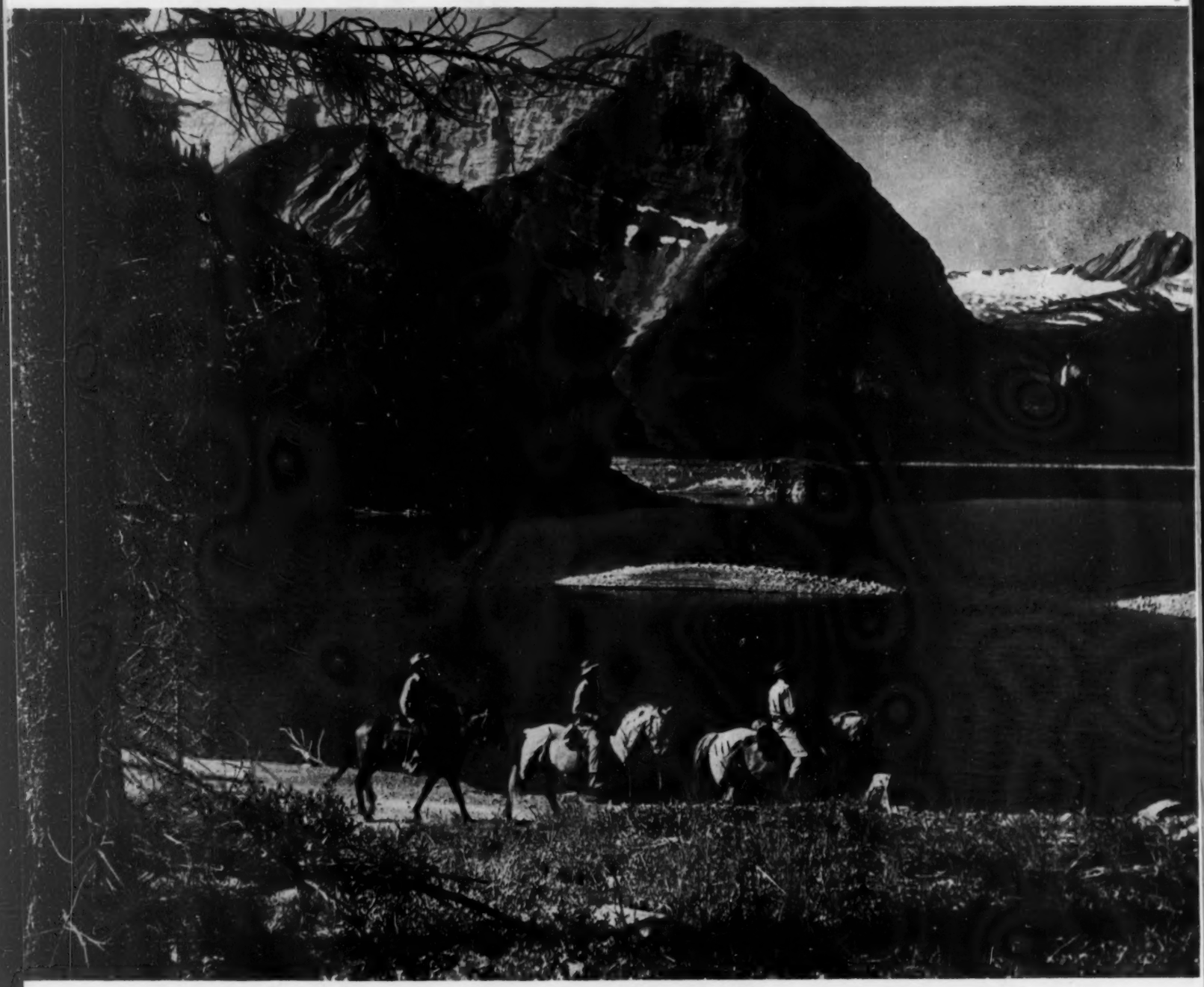
Each of these stations will have one 500 hp and two 1,000 hp centrifugal pumping units. Increased pumping capacity at the three present U. S. stations will be obtained by increasing the plunger displacement on four of the triplex pumps at each station. The fourth new intermediate station will be constructed and operated by Montreal Pipe Line Co. Ltd. of St. Cesaire, Quebec. It will have one 600 hp and two 1,200 hp centrifugal pumping units. An additional 1,000 hp centrifugal unit will be installed at the present Highwater, Quebec, pumping station to give a total of 2,750 hp on the 18-inch line at this station to match the increase made possible by the new stations. Completion of the project is scheduled for November 1, 1954.

The Portland-Montreal Pipe Line system supplies four Canadian refineries located at Montreal East with crude oil brought in by tanker to South Portland, Maine. There are two main lines from South Portland to Montreal East, one a 12-inch line constructed in 1941 and the other an 18-inch line laid in 1950. Each line at present has four pumping stations. The portion of the pipe line system which lies in the United States is owned and operated by Portland Pipe Line Corp. The installations in Canada are owned and operated by Montreal Pipe Line Co. Ltd.

An expansion program which will boost the carrying capacity of its 188-mile Sarnia products pipe line by 40 percent has been announced by Imperial Oil Ltd. The $1 million construction project, which includes two new pumping stations, will raise the throughput of the line from 39,000 to 55,000 b/d.

The Sarnia products line carries gasoline, diesel oil and heating oil from Imperial's Sarnia refinery to London, Hamilton and Toronto. It began deliveries to London in March of 1952 and to Toronto the following November.

Pumping stations will be built at London and at Waterdown, where spur lines for Hamilton leave the main line. The London pump station will have two pumping units and provision for a third. One pump will be installed at Waterdown with provision for a second later. At Sarnia existing equipment will be altered and a third pump installed. Construction is expected to be completed this fall.



Imperial Oil geologists set out on horseback looking for rock samples at Lake Kananaskis, southwest of Calgary.

1953— Geophysical activity in Western Canada

By John A. Legge, Jr.

FOR THE FIRST TIME since the discovery of the Leduc oil field, a reduction of geophysical activities in Western Canada occurred in 1953 with a total of 1,877 crew months of activity completed. This represents a decrease of 11 percent from the all time high of 2,042 crew months of work in 1952. Figure 1 shows the variation in total crew months since 1947 when the Leduc discovery started the growth of all phases of petroleum activity.

The decrease in geophysical activity has been, in terms of crew months, principally in seismograph work, as a total of 1,773 crew months were worked in 1953 as compared with 1,855 crew months in 1952, a decrease of five percent. The gravity meter similarily decreased with 104 crew months in 1953 as compared with 140 crew months in 1952, a decrease of 35 percent. No ground magnetometer work was reported during 1953 as compared with 47 crew months in 1952. Twenty-one crew months of airborne magnetometer work have been reported in Western Canada. This method has been applied largely as a reconnaissance tool in the inaccessible areas in advance of more detailed methods.

This reduction in geophysical activity is not necessarily an indication of a lessening of interest by the industry in Western Canada, but is more indicative of the fact that the movement of exploration emphasis from the Plains area is to a great extent the result of oil discoveries at Pembina and Sturgeon Lake as well as additional gas discoveries in northeastern British Columbia. This westward movement of geophysical activity, particularly seismic, to the bush and muskeg areas has brought about a marked differential between summer and winter operations. This is well illustrated in the accompanying chart (Figure 2) of seasonal variation in field work. The problem of working the bush and muskeg areas during the summer months has become increasingly acute. To date no widely accepted solution to the problem of transporting seismic equipment in these areas during the summer has been devised. Much attention has been given to the various aspects of the problem, and a solution would tend to equalize the exploration demands of the oil industry over the seasons and place the exploration industry on less of a feast or famine basis.

A small but growing tendency has been noted towards more detailed work. This is indicated by the large percentage decrease in gravity and magnetic methods which have been applied almost entirely as reconnaissance tools. Some highly detailed seismic work has been done, and if Western Canada is to follow the history of other oil provinces, more and more of this type of work will be done. It is doubtful if the Plains area will again receive the volume of attention enjoyed during the 1947 to 1952 era of land acquisition and reconnaissance exploration.

Of the western provinces, northeastern British Columbia has shown the only major increase in geophysical activity with 67 crew months, an increase of 91 percent over the 35 crew months completed during 1952. The necessity of evaluating Crown permits, coupled with the growing number of important discoveries, and the hope of an early decision on gas imports to the northwestern United States has brought about a surge of activity in this once remote area.

An increase in geophysical activity is anticipated in northeastern British Columbia during 1954, though the seasonal fluctuations will probably be relatively more severe than in Alberta. This is due to the fact that, except for small areas around the towns of Dawson Creek and Fort St. John, the current area of interest is all bush. Summer activity is economically feasible in only a small proportion of this vast area with present equipment.

Severe cutbacks in activity occurred in both Saskatchewan and Manitoba during 1953 with only 281 and 19 crew months worked respectively. This compares with 363 and 36 crew months respectively during 1952. The decrease in activity is to a great extent due to completion of much of the basic reconnaissance work. Though several important discoveries have been made in Saskatchewan and Manitoba during 1953, none were of sufficient magnitude to bring about a rush of activity as occurred in Alberta in previous years.

It is estimated that approximately $37 million was spent on geophysical exploration during 1953 as compared with an estimated $40 million during 1952. The average cost per crew month during 1954 will probably increase somewhat due to the concentration of effort in the bush areas where the operations are of a more expensive nature.

The year 1954 will probably see a further reduction in total crew months of work. An increase in activity may

Geologists John Harrison, left, and H. E. Parsons, members of Socony-Vacuum exploration crew prospecting in British Columbia, prepare to make a local plane-table survey of the region to tie in with their general map of the area.

John A. Legge, Jr., received his B.S. degree in geology from the California Institute of Technology and his M.S. degree in economic geology from the University of Arizona, where he held a teaching fellowship in mineralogy. After two and one half years with the Richmond Petroleum Co. of Colombia, S. A., he joined United Geophysical Co., serving in California and Alaska. In 1948 he joined the Texas Co. at Houston. In 1949 he was transferred to Texaco Exploration Co. in Calgary, leaving in 1951 to start his own consulting business in Calgary.

Socony-Vacuum geologist Don Stewart, member of an exploration crew searching for oil in British Columbia, examines a piece of sandstone.

occur in northwestern British Columbia, but this will probably be more than offset by decreases in Alberta where the bulk of the activity is still concentrated.

Last year saw virtual completion of the basic aerial photography of Western Canada. This work has been carried on by the R.C.A.F. working for the Federal Government and three private groups working for the Provincial Governments. All of the potential oil territory of Western Canada has been photographed and over much of the area planimetric maps have been prepared and are available to the public. The program of planimetric mapping is rapidly going ahead and soon maps should be available on all potential oil lands. Practically all of Alberta and much of northeastern British Columbia is available at present.

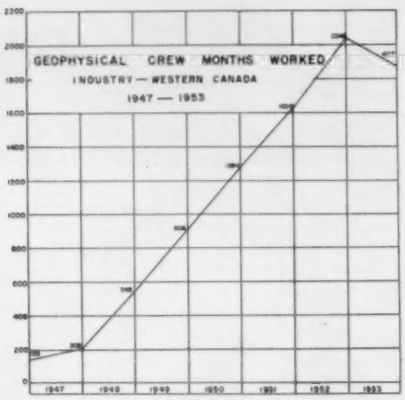


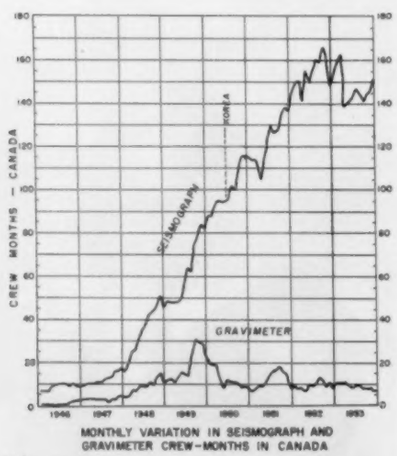
Figure 1.

Specially-designed auger drill designed for drilling in frozen muskeg by Imperial Oil Ltd.

TABLE 1

GEOPHYSICAL ACTIVITY CREW MONTHS, WESTERN CANADA

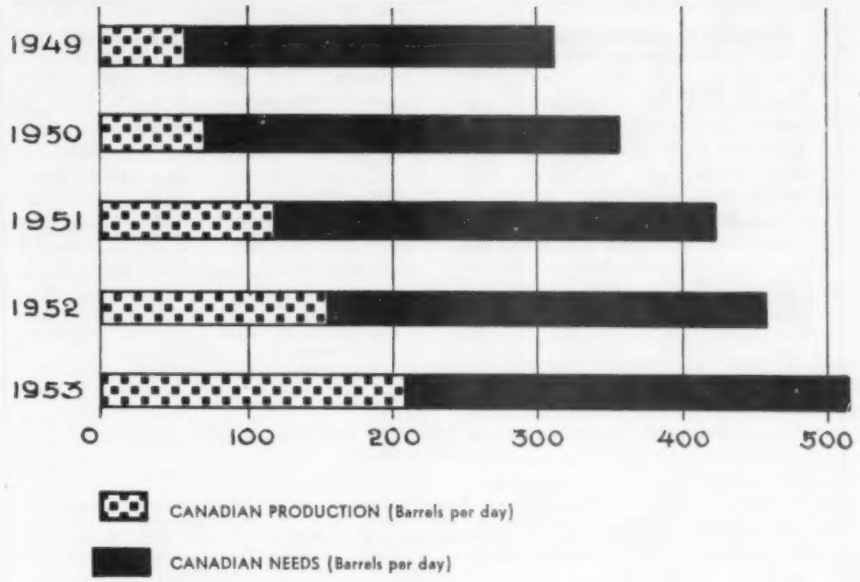
	Seismic			Gravity			Magnetometer			Total		
	1953	1952	1947	1953	1952	1947	1953	1952	1947	1953	1952	1947
Alberta	1,406	1,420	155	75	89	41	3	7		1,481	1,512	203
Saskatchewan	281	363	—	24	43	—	26			305	432	—
Manitoba	19	36	6	—	4	—	6			19	46	6
British Columbia	67	35	—	5	—	—	3			72	38	—
Northwest Territories	—	1	—	—	4	—	9			—	14	—
Total Western Canada	1,773	1,855	161	104	140	41	47	7		1,877	2,042	209



MONTHLY VARIATION IN SEISMOGRAPH AND GRAVIMETER CREW-MONTHS IN CANADA

Figure 2.

Member of a seismic exploration party near Clive, Alta., carries out geophones. Photo by Anthony Linck for Cities Service Co.



Canadian oil consumption 9.7 percent higher in 1953

THE RAPID PACE at which the Canadian oil industry has been developed since Leduc continued through 1953 and is apparent again this year. Crude production rose 32 percent, and discoveries of new oil reserves in 1953 have the greatest potential in the history of the Canadian industry, even exceeding the year in which Redwater was found. Pipe line construction completed the linkage of the Prairies with markets in the Pacific Coast and in Ontario. Refinery construction added 18 percent to the Dominion's plant capacity, but still failed to keep pace with the increase in demand for petroleum products, which rose 9.7 percent. Canada, despite its growth, still produces less than half the oil it requires. Per capita oil consumption is the second highest in the world, and total consumption is the third largest of any nation in the world.

Capital investment requirements in the Canadian industry continue to approximate a half billion dollars per year. Crude production and exploration again will absorb a million dollars per day in 1954. Pipe line expansion will cost $80 million or more this year, and refineries at least $50 million. Marketing facilities also must be expanded currently. Canadian Oil Companies Ltd., for example, is opening an average of one new modern service station per week.

Development of the natural gas industry in Canada will not begin to call for large amounts of new capital until 1955. That year and the following will witness the spending of vast sums for gas processing, transportation and distribution. Assuming that Canadian gas is exported to the Pacific Northwest and to the Twin Cities area in the United States and piped to Eastern Canada, the required investment in plant will exceed $1 billion. Drilling also will be stimulated when gas can be sold.

The general economy of Canada has been expanding at a rapid rate since the

Note: The editors of WORLD PETROLEUM *acknowledge with thanks the generous assistance of John F. Fairlie, manager of the Co-ordination and Economics Department of Imperial Oil Ltd., in supplying data for the above article to supplement current figures of the Dominion Bureau of Statistics.*

PROGRESS TOWARD SELF SUFFICIENCY
(Barrels per Day)

Year	Production*	Needs	Percent Sufficiency
1949	58,806	319,961	18.4
1950	79,709	367,254	21.7
1951	131,866	420,227	31.4
1952	168,825	466,962	36.2
1953	223,200	512,000	43.6

*Includes natural gasoline.

MOTOR VEHICLE REGISTRATIONS

Year	Cars	Trucks & Buses	Total Motor Vehicles
1940	1,234,637	250,550	1,485,187
1945	1,160,058	319,609	1,479,667
1950	1,650,641	544,288	2,194,929
1951	2,071,826	693,329	2,765,155
1952	2,242,200	756,800	2,999,000

CANADIAN SUPPLY AND DEMAND FOR OIL
(Thousands of Barrels Daily)

	1951	1952	1953*
Demand			
Total Demand	410.6	473.1	519.5
Exports	2.2	6.1	7.5
Domestic Demand	408.4	467.0	512.0
Supply			
Crude Production	130.3	167.3	221.6
Other Production (1)	8.9	3.1	3.6
Crude Imports	227.8	225.3	223.0
Product Imports	67.0	92.7	96.8
Total Supply	434.0	488.4	545.0
Inventory			
Stock Changes	+23.4	+15.3	+25.5

(1) Field natural gasoline, propane and butane.
* Estimated.

ESTIMATED PROVED RESERVES OF CRUDE OIL AND NATURAL GAS LIQUIDS*
(Thousands of Barrels)

	Proved Reserves as of 12/31/52 (1)	Changes in Proved Reserves Due to Extensions (New Oil) and Revisions during 1953 (2)	Proved Reserves Discovered in New Fields and in Old Fields in 1953* (3)	Production During 1953 (4)	Proved Reserves as of December 31, 1953 (Columns 1+2+3 less column 4) (5)	Changes in Reserves During 1953 (Col. 5 less Col. 1) (6)
Crude Oil						
Northwest Territories	26,767	———	———	325	26,442	(—)325
Alberta	1,526,389	143,194	31,731	76,818	1,624,496	98,107
Saskatchewan	124,247	1,609	59,101	2,798	182,159	57,912
Manitoba	2,106	6,360	3,080	656	10,890	8,784
Ontario & New Brunswick***	———	769	979	313	1,435	1,435
Total Crude Oil	1,679,509	151,932	94,891	80,910	1,845,422	165,913
Natural Gas Liquids*	65,374	91,675	42,323	1,246	198,126	132,752
Total Liquid Hydrocarbons in Western Canada	1,744,883	243,607	137,214	82,156	2,043,548	298,665

*Prepared by Central Reserve Committee of the Canadian Petroleum Association composed of Messrs. G. A. Connell, Royalite Oil Co. Ltd., chairman; W. E. Perkes, Tide Water Associated Oil Co., vice chairman; R. W. Diamond, Canadian Petroleum Association, secretary; W. B. Dingle and H. F. Naldrett, Imperial Oil Co. Ltd. Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, because in this report the committee is concerned only with actually proved reserves. Hence figures in this column may be considered minimum figures.
**All natural gas liquids are located in Alberta.
***Not reported December 1952.

close of World War II. Population passed 15 million in 1953, an increase of a million in two and a half years. The birth rate is high and the death rate low, immigration is substantial and the loss of population through emigration decreasing.

Currently there is some readjustment in progress in Canada as there is in the United States. The readjustment reveals itself largely as a slight reduction in the post-war rate of increase in business activity. In 1953 industrial production was five percent above 1952. Construction was up 11 percent. Personal income was six percent higher than in 1952 and retail trade up five percent. Prices were steady.

Gross national production in Canada was $24,300 million in 1953 and investment in new building and equipment totaled $5,700 million, 23 percent of gross national product. Capital investment requirements necessitated a continuing flow of money from the United Kingdom and the United States with the result that the Canadian dollar was at a premium throughout the year.

In the past seven years $1,990 million in new capital has been invested in Canadian oil. It is estimated that the Canadian industry obtained $570 million from the sale of new securities and reinvestment from current income. The U. S. oil industry supplied $580 million, the oil industry in other countries $10 million. The investing public supplied $830 million.

Imports of goods were at a record level in 1953, but exports decreased to create an unfavorable balance. The high value of the Canadian dollar contributed to this. Indications are that exporters of merchandise will continue to face keener competition in foreign markets this year, but that the Canadian economy will be kept stable by exports of the natural resource industries and a reduction in the foreign exchange requirements for imported oil.

The flow of speculative capital into Canadian oil was much smaller in 1953 than in earlier years. Money from abroad came more from large international companies with growing interests in producing and manufacturing. Canadian oil stock prices generally tended lower throughout the year as the industry became more mature. In recent months there have been a considerable number of mergers among smaller oil companies in an effort to strengthen their financial position, now that it is not so easy to sell more stock for wildcatting. Few new "penny" oil stocks were being floated.

At the close of last year the market value of oil securities listed on the Toronto stock exchange was about $3 billion. Of this, about a billion was represented by foreign investment and two billion by domestic. This was a drop of about $600 million under the peak reached in 1952 at the height of the fever. Many of the "penny" stocks were selling at half their highest 1952 levels. The reduction in market values of the better established companies was less apparent. As some put it: "The men and boys are being separated."

Canadian producers were not entirely satisfied with market demand for crude in 1952, although they were able to lift 80.9 million barrels compared with 61.2 million the previous year, an increase of 32 percent. Most dissatisfaction was in Alberta, where proration is severe. At the end of the year, potential of Canadian fields was about 350,000 b/d, and average production for the year 221,600 b/d, the shut-in oil totaling about 125,000 b/d. In 1954 it is estimated that transportation facilities will permit the delivery of about 285,000 barrels of crude per day to refineries, another increase of 28 percent.

The rate of production increased more rapidly in Saskatchewan, Manitoba and Ontario than in Alberta last year as indicated in the following table.

Thousands of Barrels Daily

Province	1953	1952	Percent Increase
Alberta	210.4	161.1	30.4
Saskatchewan	7.6	4.7	64.0
Manitoba	1.8	0.3	510.0
N.W.T.	0.9	0.9	———
Ontario	0.7	0.5	40.0
New Brunswick	0.4	0.4	———
	221.6	167.9	32.0

Value of crude and natural gasoline produced in 1953 exceeded the value of any other Canadian mineral production for the first time in 1953.

Canadian crude reserves at the end of 1953 as officially estimated by a committee of the Canadian Petroleum Association totaled 1,845 million barrels, an increase of 166 million barrels over 1952. Reserves of natural gas liquids rose 133 million barrels to 198 million barrels. The Association committee estimates reserves on the same basis as that adopted by a similar committee of the American Petroleum Institute. The estimates thus do not begin to approximate the potential of the important Pembina, Sturgeon Lake and Smiley discoveries.

In making application for permission to build a pipe line gathering system at Pembina and a spur line to market, estimates of Pembina reserves were placed at 762 to 953 million barrels by various applicants. Other estimates suggest that Pembina will yield well over a billion barrels and may prove to be the largest single oil reserve in Canada. Production from the Cardium sand has been proven over an area perhaps 50 miles long by 16 miles wide. The area also is underlain by other potential producing horizons.

More wells were drilled in Western Canada last year and footage cut was greater. In Western Canada 898 exploratory wells were drilled in 1953, compared with 900 in 1952. Development well drilling rose from 1,221 in 1952 to 1,376 in 1953. Total footage drilled in Western Canada rose from 8,712,833 feet in 1952 to 9,139,852 feet last year. Geophysical reconnaissance was somewhat less active than in the preceding year, the first such dip since Leduc.

Canada's refining capacity rose 50,700 barrels in 1953 to 500,100 b/d on January 1, 1954, an increase of 11 percent. Completions scheduled for this year will bring Dominion capacity to about 556,000 b/d. The total in sight by the end of 1956 is around 600,000 b/d.

Domestic demand for petroleum products in Canada has been rising at more than twice the rate attained in the United States. The increase was more than 14 percent in 1950 and 1951, 11.1 percent in 1952 and 9.7 percent in 1953. All principal products have participated in the enlarged market.

Fuel oil demand has risen satisfactorily, despite the tremendous post-war growth in hydroelectric power. In Canada 95 percent of the energy for the generation of electricity comes from water power, compared with less than a third in the United States. The Dominion has invested $3 billion since the war to boost hydroelectric power roughly 60 percent to about 16 million horsepower. More new water power is coming: 450,000 hp this year at the Kitiwat aluminum project in British Columbia, an increase of Niagara power to 1,300,000 hp; 1,100,000 hp from the St. Lawrence seaway; and an ultimate million horsepower near Quebec. All are building or planned.

Heavy fuel demand in Canada in recent years has been as follows:

YEAR	THOUSANDS OF BARRELS
1946	17,294
1947	20,342
1948	22,308
1949	23,603
1950	26,973
1951	32,033
1952	33,401
1953	35,414

Domestic oil burners and oil stoves are installed in a growing number of Canadian homes. The upward trend indicated in the tabulation following doubtless will be less abrupt after 1955 when natural gas is expected to be available in the east and on the west coast. The proposed Trans-Canada gas line will make available the equivalent of 40,000 b/d of fuel oil to Ontario and Quebec when it is completed late in 1956. Obviously not all of this market will be developed at the expense of coal. Since new gas lines have been laid in the United States, the rate of increase in domestic and industrial fuel has fallen, but the trend has continued upward. Doubtless the same will be true in Canada.

YEAR	OIL-HEATED HOMES IN CANADA	DISTILLATE FUEL CONSUMPTION (THOUSANDS OF BARRELS)	
		No. 1	*Nos. 2 & 3*
1950	740	6,779	13,816
1951	910	8,488	17,918
1952	1,088	8,087	21,426
1953	1,260	9,175	23,709

Dieselization of Canadian railroads is paralleling that in the United States. Diesels also are used instead of coal for generation of electric power in areas remote from water falls.

Diesel fuel consumption in 1953 totaled 10,030,000 barrels compared with 8,885,000 barrels in 1952, an increase of 12.9 percent.

Canadians, like their neighbors to the south, are great users of automobiles. Last year 52 percent of all homes had motor cars. Total vehicle registration rose 8.2 percent to 3,410,000, an average of one vehicle to four persons. Tractors in use rose 5.7 percent to 469,000. There now are tractors on 75 percent of Canadian farms. The recent trend in registration follows:

YEAR	MOTOR VEHICLES	TRACTORS
1950	2,601	377
1951	2,851	415
1952	3,150	444
1953	3,410	469

Imports of crude oil decreased materially in 1953, although it was necessary to bring in 77,000 b/d of refined products to supplement the output of Canadian refineries. The following table compares the sources and volumes of crude imports for 1953 with 1952:

COUNTRY	1953	1952
	(Thousands of Barrels)	
Venezuela	56,661	51,017
United States	14,318	20,056
Arabia	6,905	8,380
Trinidad	2,395	1,833
Borneo	—	860
Mexico	—	322
Total	80,279	82,468

Canadian self-sufficiency in oil reached 44 percent in 1953 compared with 36.2 percent in 1952 and 7.8 percent in 1947.

Canadian refineries operated at about 87 percent of rated capacity in 1953. Crude run to stills increased 44,000 b/d to 423,000 b/d. In 1952, runs had averaged 379,000 b/d.

Net earnings of old-line integrated companies in Canada increased sharply in 1953. As this is written, annual reports have been received from Imperial, British American, Canadian Oil Companies, McColl-Frontenac and Royalite Oil. This group reported an increase in net profit of 22 percent in 1953, rising to $77.1 million from $63.1 million in 1952.

A conservative dividend policy was maintained again in 1953, and more than half of the net was plowed back into expansion. Long term debt of the four companies was reduced $6 million to $161.3 million, despite capital expenditures totaling $112.9 million.

In his report to shareholders, Ole Berg, president of British American, stated that last year was the first since 1944 in which the company was able to finance its capital investment substantially out of funds from operations without any long term borrowings or by issuance of capital stock. The company spent $33.6 million for capital goods in 1953 and its long term debt was reduced $5.1 million to $42.5 million, a drop of 10.7 percent. Stockholder equity rose $1.77 per share during the year despite an increase of the dividend rate from 50 to 70 cents per share.

Imperial Oil Ltd. also increased its dividend rate in 1953. The increase was from 75 to 80 cents per share. The company retained half its earnings in the business to achieve a reduction of $2.5 million in long term debt and increase total assets $30 million to $561.3 million.

Extension of the Interprovincial pipe line to Sarnia last year reduced the need of both Imperial and Canadian Oil Companies for lake tankers. Canadian Oil wrote off $765,000 for a tanker it had ordered and found unnecessary. Imperial also charged off $903,334 for additional depreciation and obsolescence.

Imperial spent $67.8 million for capital goods in 1953 compared with $71.1 million the previous year, $22 million net for producing facilities, $25.6 million for refineries and $16.9 million for marketing facilities.

Imperial is the largest operator in the Canadian industry. Last year it produced 32.9 million barrels of crude, 41 percent of the nation's output. Refineries processed 70 million barrels of crude or 56.6 percent of Canadian runs.

Last year was the first full year in which Canadian Oil Companies Ltd. operated its new Sarnia refinery. The company was able to increase its sales 28 percent to an all-time high of $56.2 million. Gallonage was double that sold in 1949. In addition to writing off the tanker, as mentioned above, the company completed a write-off of $385,200 for starting up the new refinery. Dividends paid were unchanged at 50 cents per share. Earnings rose from 80 cents in 1952 to $1.06. Capital expenditures totaled $3.1 million. Currently a large share of this is being devoted to expansion of marketing facilities.

Royalite Oil Co. Ltd. continued to expand its operations in 1953. Capital ex-

(Continued on page 214)

R. R. McDaniel, division reservoir engineer for Imperial Oil Ltd. in that company's western division, is a native of Canada who has been engaged in that phase of oil engineering since his graduation from the University of Oklahoma in 1947. He spent two years with Creole Petroleum Corp. at Maracaibo, Venezuela, in production and reservoir engineering before being transferred to Imperial's staff at Calgary.

Pressure maintenance in Western Canada

By R. R. McDaniel

PRESSURE MAINTENANCE operations have been started in a number of Western Canadian oil fields of which the Golden Spike South D-3 and the Leduc D-2 projects are probably the most significant. Similar plans are also being considered for the Redwater, Acheson and Leduc D-3 fields. The majority of the reservoirs in the area are still in initial stages of production, and therefore secondary recovery, in the true sense of the word, has little application.

A reliable evaluation of the feasibility of pressure maintenance is dependent upon the quality and quantity of reservoir data available. Western Canadian operations are presently enhanced by the fact that excellent data are being collected on both the individual wells and the reservoirs as a whole. The various regulatory bodies require that much of these data be collected. It is necessary in most cases that electric or radioactive type logs be run on all wells. The operators often supplement this information with other types of logs when it is felt that a better interpretation can be obtained. The majority of the proven reserves of Western Canada are found in limestone or dolomite type reservoirs. Since this is the case, diamond coring has become a common practice to ensure better core recovery and more representative samples. The analysis of the large diameter core was primarily developed in Western Canada and is now practically the only method used in this area. The advantages of this technique have been so great that diamond coring is now being employed in many of the sandstone fields. Accurate drilling and completion data are required on all wells. These factors, combined with reliable pressure-production data, provide an excellent basis for all studies. Pressure surveys are taken on the more important fields at regular intervals. Accurate reservoir fluid sample analysis data have been collected on nearly all pools. A 40-acre spacing pattern is employed in most areas. Adjustments in the spacing unit to be used in development may be obtained if the reservoir characteristics definitely warrant it.

The majority of the large oil reservoirs of Western Canada have been found in the Province of Alberta. The reservoirs of this area generally contain light gravity crudes, and therefore the possibility of instituting successful pressure maintenance projects is increased. In most cases the oil is trapped in reefs or their remains. The reefs or bioherms are usually found to have substantial thickness, and therefore form excellent reservoirs. They are usually composed of vuggy and granular materials and are generally very permeable. Unless the reef is entirely oil filled as is the case at Golden Spike, a large aquifer will be found below the oil zone. As a result, bottom water drives exist in most cases, some being highly effective, while others will require assistance in order that the reservoirs may be produced efficiently. This type of water drive, in which the water migrates essentially in a vertical direction, is highly efficient in that the rate of water advancement is slow and gravity segregation possibilities are at a maximum.

Nearly all the fields are relatively new, and therefore it is often difficult to predict accurately the future performance of the natural reservoir drives. In view of the beneficial effects of initiating pressure maintenance in the early life of a field, the latest mathematical and electrical analyzer techniques are being employed to evaluate the individual cases. Abundant fresh water supplies can be obtained in most areas from local rivers. Plentiful gas reserves are also nearly always available close at hand. Therefore, the question of adequate water or gas supplies is of little concern in proposing any given pressure maintenance project.

Most of the fields in which pressure maintenance projects are either being considered or carried out are located in the Province of Alberta. The regulatory body of this Province is known as The Petroleum and Natural Gas Conservation Board. This group maintains a close scrutiny of all reservoir information and has been largely responsible for the excellent quality of basic data available to indus-

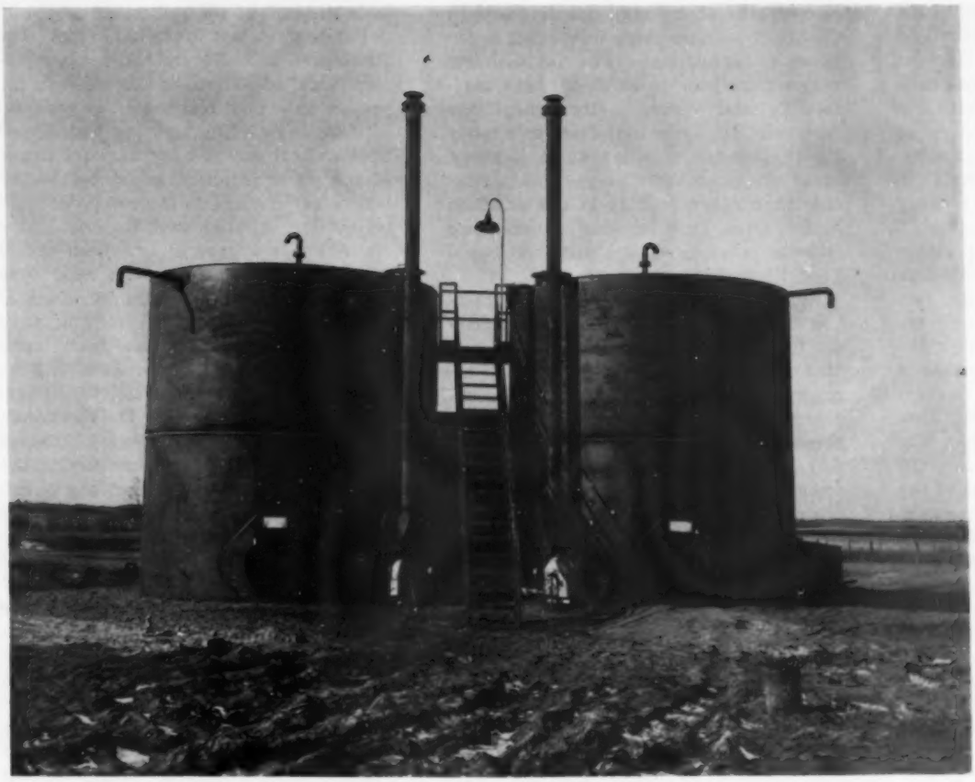


Figure 1. Heaters installed in water tanks employed in the Leduc D-2 pilot test. It is necessary to heat water even though it may be a highly concentrated salt solution because of the low temperatures encountered in winter months.

try in this Province. The Provinces of Saskatchewan and Manitoba are following similar procedures and equally satisfactory data should be obtained in those areas. The operators have also taken forward steps by forming associations to study most of the important reservoirs. Active engineering groups have resulted from these associations and considerable work has been done toward the institution of pressure maintenance in several fields.

Winter conditions, which may require the operation of plants and facilities in temperatures as cold as 50° below zero (F) have been mostly overcome. This is not considered a serious problem by the operators, but it has a number of disadvantages. The principal hindrance is that it is necessary to bury all fresh and salt water gathering or pipe line systems below the deepest frost penetration. In view of the fact that this depth may exceed six feet, it is not feasible to install these lines during the winter months when the ground is frozen. As a result, all such construction programs must be planned for the warm weather. It is also necessary to install heaters on water tanks even though highly concentrated salt water may be in temporary storage. A typical set of installed heaters is shown in Figure 1, a picture of the tanks used for the Leduc D-2 pilot test project. There are some advantages of the northern climate such as the long summer daylight hours and the fact that equipment can be moved over marshy ground a lot more easily during the winter. River crossings can also be much more easily constructed during the cold months by working on the ice.

Each individual pressure maintenance project would make a lengthy article in itself. An attempt will be made here to present the highlights of a number of the projects which have been either initiated or are in discussion stages. The basic reservoir data for each of the fields is given in Table I.

The Golden Spike D-3 pressure maintenance project has been initiated, although less than four percent of estimated recoverable oil has been produced. This reservoir, which was discovered in the spring of 1949, is situated approximately 20 miles southwest of the City of Edmonton, Alberta. (See Figure 2). It is unique in that it averages about 520 feet in thickness, yet covers an area of only 1,100 acres. (See Table I). It is a Devonian limestone reef composed primarily of porous granular and vuggy materials. Core analysis results and interference tests have indicated excellent horizontal communication. A wide spacing unit of one well per 160 acres was found to be feasible because of the high productivity of the wells. No water was encountered in the basal portion of this reef nor has the pressure-production history indicated any water drive. Four and a half million barrels of oil have been produced to date. The pressure has declined some 700 psi and is now approximately at the bubble point. (See Table I). This rapid decline can be attributed to the fact that the only effective reservoir drive mechanism has been the expansion of the undersaturated reservoir fluid.

If the pressure were allowed to decline with depletion, the expected recovery would be about 45 percent of the oil in place. In view of the fact that the stock tank oil in place has been estimated to be approximately 250 million barrels, extensive studies of the pressure maintenance possibilities were commenced shortly after the rapid pressure decline became apparent. These investigations included gravity segregation calculations and a thorough laboratory study of the reservoir rock and fluid characteristics. The results of these studies indicated that pressure maintenance above the saturation pressure employing either gas or water injection would give recoveries in excess of 60 percent of the oil in place. Therefore, it was decided to initiate a pressure maintenance project. The decision to inject gas rather than water was based on the following factors:

1. The base of the structure was found to be less porous than the upper portion and, therefore, localized entrapment of oil might occur if water were injected.

2. A plentiful supply of gas could be obtained from the adjacent Leduc-Woodbend field.

3. Gravity segregation calculations indicated slightly better recoveries with gas injection.

4. New depletion methods which are being developed and might be applicable in this case would probably be more easily initiated if gas were the injected fluid.

The usual problem of requiring agreement among the operators and lessors was not necessary in view of the fact that Imperial Oil Limited is the only operator and the Province of Alberta the only lessor. It was necessary to submit the plan to both the Provincial Government and The Conservation Board. Permission to proceed with the project was granted.

Figure 3 is a schematic diagram of the project in operation. The produced gas is stripped of its heavier ends and is returned to the crest of the structure through an injection well. This volume of gas is not sufficient to maintain the reservoir pressure, and therefore must be supplemented from other sources. These supplies will include solution gas from the Leduc-Woodbend field as well as dry gas from upper formations of the Golden Spike field. The majority of Leduc-Woodbend gas is presently directed to consumer markets where the demand is much higher in the winter than the summer. As a result, it is anticipated that excess volumes may be injected during the warm months so that greater quantities can be directed to consumer markets during the cold weather. This will require considerable flexibility in operations but will be an excellent conservation plan. The Golden Spike gas injection station is very simple because it was installed only for the purpose of stripping the wet gas and compressing the dry gas to be injected. The raw product is shipped by pipe line to the nearby Leduc Conservation Plant No. 1, where it is processed.

At the present pressure level, trouble has been experienced in starting the producing wells to flow. Very high rates of production are also anticipated. As a result, it is planned to raise the reservoir pressure to approximately 2,000 psig or some point where these conditions can be overcome. This project has employed some of the latest reservoir engineering concepts and it is hoped that as additional processes are developed the recovery efficiency will be improved even beyond the presently estimated 60 percent.

The Leduc D-2 field is situated immediately southeast of the Golden Spike pool. It was the discovery of this field in 1947 that marked the beginning of the present oil boom in Western Canada. The pertinent reservoir data have been summarized in Table I.

The reservoir is located in a combined structural and stratigraphic trap. The D-2 formation is a blanket type reef averaging around 150 feet in thickness. It is composed of a vuggy dolomite and in the upper portions contains varying quantities of anhydrite. The permeability varies from poor to excellent, both horizontally and vertically throughout the reservoir. It may be considered as a fairly tight reservoir although some localized areas are much more porous and permeable than others. It is in one of these better areas that pressure maintenance is being commenced on a pilot test basis. (See Figure 2).

Studies have indicated that the reservoir has been produced to date primarily by a solution gas drive mechanism. It is evident that a relatively low recovery would result if this drive mechanism were allowed to predominate throughout the life of the field. Therefore, pressure maintenance studies were commenced with a view to increasing the ultimate recovery. The first studies were based on the principle of utilizing distributed fluid injection. The findings indicated that in several areas either water underlies the oil zone or gas overlies it, and therefore the efficiency of any flooding project would be very questionable in those areas. A closer study of the reservoir indicated that in at least one area it might be more desirable to attempt a pressure maintenance project by water injection into the underlying aquifer. The area considered covers about 2,000 acres and has a total porous thickness of approximately 110 feet of which the upper 90 feet contains oil, leaving a water zone of 20 feet. It was also noted that the porosity and horizontal permeability of the water zone were much higher than that found in the oil zone. A number of water flooding susceptibility tests were then conducted which indicated that an increase in ultimate recovery might be expected. The pilot area was selected and an injection well located. An ample supply of fresh water was available from the North Saskatchewan River two miles away. (See Figure 2). It was also planned that this well should be used for the later disposal of the salt water produced.

Permission was received from The Petroleum and Natural Gas Conservation Board of Alberta to proceed with the project on a pilot test basis. A program of close engineering scrutiny was agreed upon so that any possible harmful effects of the water injection might be checked before any damage to the reservoir could occur. The injection well, Imperial Leduc No. 600 (see Figure 2), has been drilled and completed. The water zone was acidized and injection rates in excess of 6,000 barrels per day on vacuum were established. Injection has been commenced, and it is hoped that it will be possible to inject approximately 3,000 barrels of water per day into the formation. The fresh water supply is being obtained from a well in a gravel bar beside the river and is relatively free of any harmful constituents. This water is being chlorinated and further treatment will not be initiated unless it is proven necessary. The actual well-head equipment is very simple as both the fresh and salt water are presently being injected without pressure application. As a result, it was only necessary to install storage tanks for the salt water. (See Figure I).

Although it will require a fairly long period to evaluate this pilot test, it is expected that the preliminary findings should indicate whether or not similar projects could be considered in other areas of the Leduc D-2 reservoir.

Two other projects are presently in operation in Western Canada. One is in the old Turner Valley field of Alberta, the other in the new Daly field of Manitoba. The fields are both producing light gravity crude from a relatively tight limestone formation of Mississippian age. Both projects are employing water flooding on a distributed fluid injection plan. Unlike the other projects, high injection pressures are required. The Turner Valley project has been operating for approximately five years and it is understood that at least some success has been indicated.

TABLE I

PROPOSED AND INITIATED PRESSURE MAINTENANCE PROJECTS
BASIC RESERVOIR DATA

Field	Golden Spike	Leduc	Leduc	Acheson	Redwater
Zones (All Devonian) ..	D-3	D-2	D-3	D-3	D-3
Discovery Date	1949	1947	1947	1950	1948
Area—Acres	1,100	32,000	22,000	3,700	38,000
Depth—Feet	5,600	5,000	5,300	5,000	3,200
Spacing Unit—Acres ...	160	40	40	40	40
Reservoir Rock Type	Limestone	Dolomite	Dolomite	Dolomite	Limestone
Crude Gravity—°API ..	37	38	38	37	35
Original Pressure—psig .	2,095	1,770	1,894	1,720	1,050
Present Pressure—psig ..	1,385	1,375	1,735	1,650	750
Saturation Pressure—psig	1,385	1,770	1,894	1,720	485
Average Thickness—feet.	520	60	34	80	100
Average Porosity—% ..	9.2	3	8	9	6.5
Connate Water—%	20	20	15	15	25
Permeability	Excellent	Fair	Excellent	Excellent	Good
Average Rate of Prod. (1953) b/d	5,700	21,400	38,600	6,400	63,800

Note: A number of the above factors are the writer's estimates and may not agree with other opinions.

The Daly project is very new and no data or results are available.

At least three more pressure maintenance projects are presently being considered in Alberta. Included in this group are the Redwater, Acheson and Leduc D-3 fields. All three reservoirs have natural water drives. However, the pressure in each case is falling more rapidly than is desired, even though most of the produced salt water is being returned to the respective aquifers. A plentiful supply of fresh water exists in each area and plans for pressure maintenance by water injection are being studied.

The Redwater field is the largest proven oil reservoir in Western Canada and therefore any consideration of a project in that pool is important. The reservoir is located in the upper edge of a large, gently dipping Devonian reef. Even though a large aquifer exists, a rapid pressure drop has occurred. (See Table I). The reservoir fluid is undersaturated, and therefore the water influx is presently the principal reservoir drive mechanism. The withdrawal rates have been reduced so that the pressure will not decline below the bubble point. Pressure maintenance by water injection would correct this situation and allow much larger producing rates without any loss in ultimate recovery.

The tentative plans which are still in discussion stages call for a number of wells by which fresh river water could be injected into the lower water-bearing portions of the reef. The injected water would initially supplement and later replace the natural influx. It is actually a relatively simple plan, but would be a major construction project in that it is presently estimated that rates of injection as high as 200,000 barrels per day might be required. No elaborate water treatment is planned since a fairly clean fresh water is available. It is felt that the injectivity of the injection wells will be sufficiently high so that a gravity system can be installed. Tests on some of the existing salt water disposal wells indicate that the injection wells might be able to handle as high as 50,000 barrels per day with no surface pressure application. It is interesting to note that very large line pipe sizes, some exceeding 24 inches, would be required to handle this volume of water. Further details of this proposed project have not been completed, and therefore do not warrant discussion at this time.

The Acheson and Leduc D-3 reservoirs are situated on the same reef trend and are quite similar. The only major differences are that the Leduc reservoir is larger and has an extensive gas cap, whereas the Acheson field has only a small gas cap, but a much thicker pay section. (See Table I and Figure 2). Both of these reservoirs have active bottom water drives but undesirable pressure declines. It is presently felt that in either case one or two wells would have sufficient injectivity on a vacuum to handle the volumes of water required to maintain the reservoir pressure at their present levels. The aquifer section in these fields is approximately 1,000 feet thick, and therefore very large volumes of water could be injected into the lower portions without danger of any localized coning. It is interesting to note that communication throughout both reservoirs is so good that pressure differentials across the respective reservoirs are practically nonexistent. Considerable progress has been made toward the initiation of these projects and it is hoped that they will be commenced in the near future.

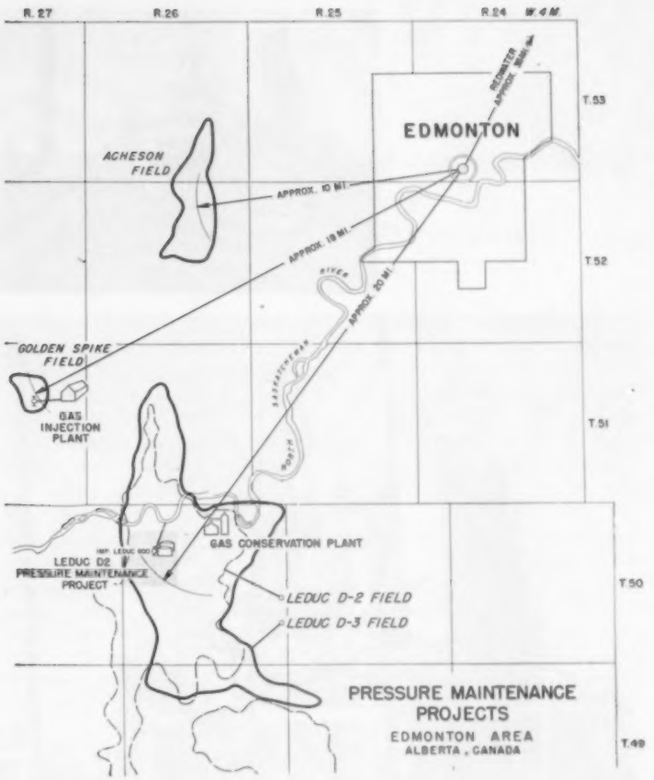


Figure 2. Map showing pressure maintenance projects in the Edmonton area.

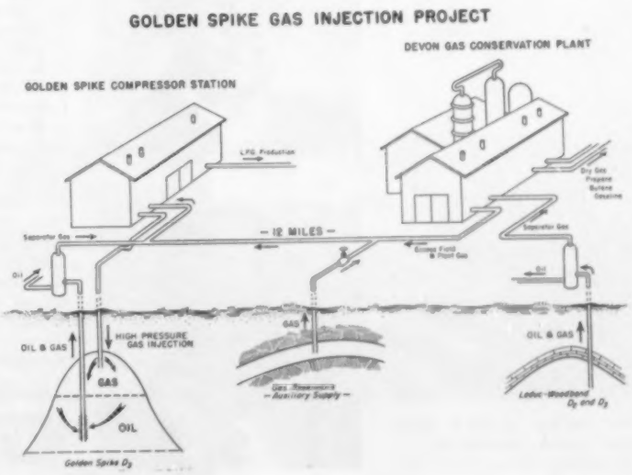
Conclusions

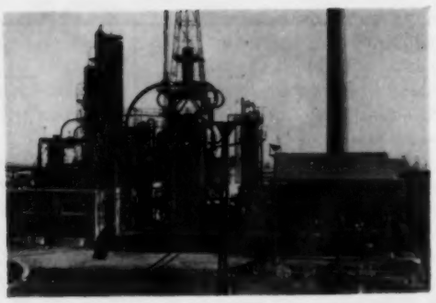
Pressure maintenance is being applied in a number of Western Canadian oil fields, even though they are, as a whole, in very early stages of depletion. The increases in ultimate recovery and production potential which will result from those projects presently planned or in operation will have a marked effect on the oil industry in Western Canada.

Acknowledgment

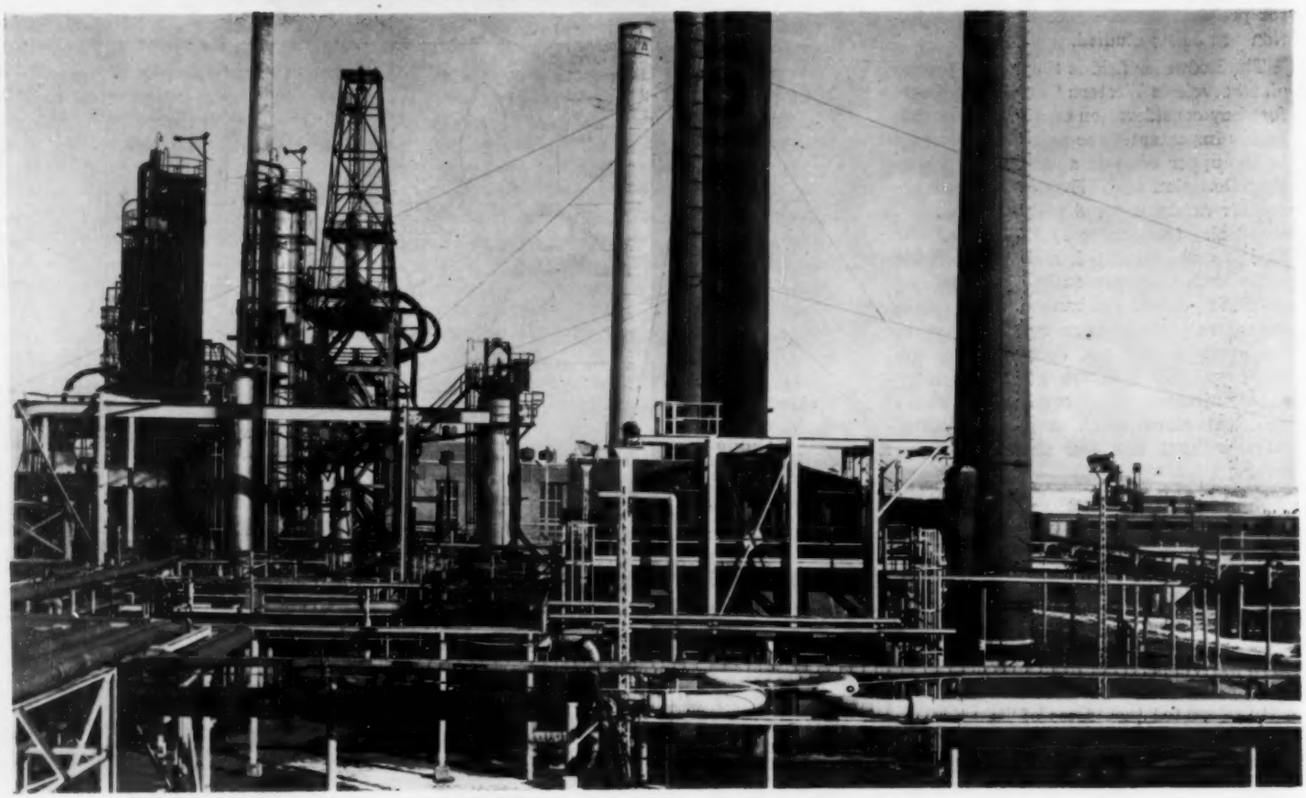
The writer wishes to thank Imperial Oil Limited for permission to publish this article as well as those associates who assisted in its preparation.

Figure 3. Diagram showing scheme to be followed in Golden Spike gas injection project.





Left, (1A), original Dubbs combination topping and thermal cracking unit commissioned in 1933. Below, (1B), same view today showing additional furnace and fractionating capacity installed in interim.



Philip Gordon is technological department manager of Shell Oil Company of Canada, a position he has held since 1949. Mr. Gordon joined Shell as a laboratory tester in Montreal in 1939 following his graduation from McGill University. He became chief chemist at the Toronto laboratories in 1942, but returned to Montreal a year later to aid in starting up the alkylation unit.

G. Davidson, who is manager of Shell Oil Company's Montreal East refinery, joined the Shell group in 1925 after graduating in applied chemistry at Glasgow University. He gained his early refinery experience in Mexico and Aruba, N.W.I., later specializing in lubricating oil manufacture in the U. S. until he returned to England in 1939. After five years in refinery work there, he served until 1951 with Shell in New York, coming to his present position in Montreal in 1951.

Evolution of a refinery

Technological development and bottleneck removal multiply Shell's Montreal East refinery capacity ninefold in twenty years

By P. Gordon and G. Davidson

RECENT YEARS HAVE SEEN many changes in the Canadian petroleum refining industry. Refining capacity has been steadily increased to keep pace with soaring demands and many new processes have been installed to meet the challenge of new quality requirements. Much of this new capacity — especially that installed during the last five years—has taken the form of complete new refineries. However, greatest gains have been achieved by expansion of plants which had been established for 20 to 30 years in centers such as Montreal, Sarnia and Vancouver.

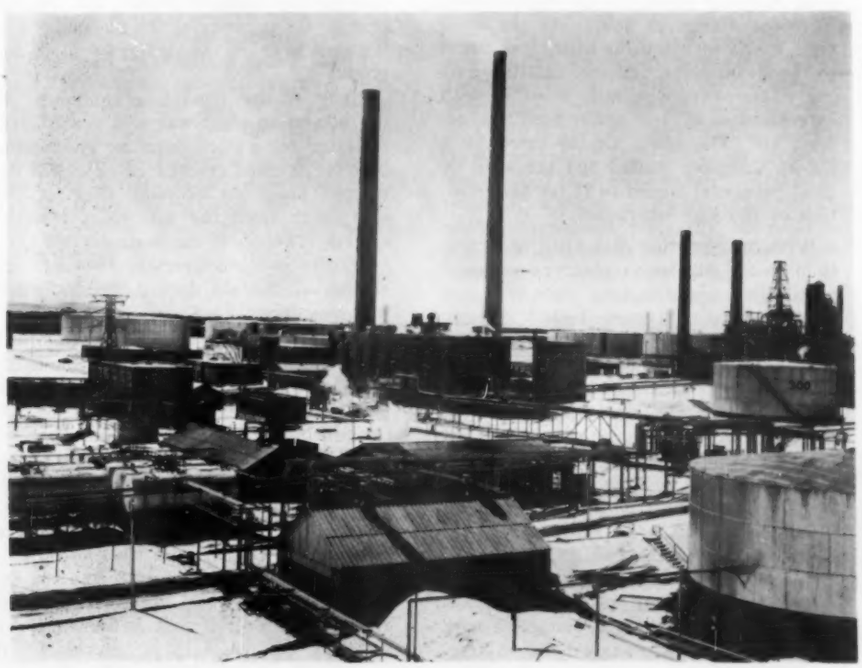
Shell's refinery at Montreal East is typical in many ways of these larger Canadian installations. The refinery, as established in 1933, consisted of a single Dubbs combination topping and thermal cracking unit, so integrated that it could be supervised, operated and controlled as a single plant. (Photo 1-A). Design throughput was 5,000 b/d of East Texas crude and facilities were provided to permit production of straight run and thermal gasoline and bunker fuel oil. A small stabilization plant including absorption facilities for recovery of butane and propane was provided, together with Gray vapor-phase and doctor treating units for thermal cracked gasoline. All necessary auxiliaries required for operation of these units, such as steam plant, facilities for pumping cooling water from the nearby St. Lawrence River, the electric power system, a small office building (including laboratory), shops, etc., were built at the same time. (Photos 2-A and 2-B).

These facilities operated successfully at 7,500 b/d, producing two grades of motor gasoline and a single grade of residual fuel. Test runs indicated that capacity could be increased to 10,000 b/d by withdrawing a side stream of kerosine and gas oil from the crude, thereby unloading the cracking furnaces which were limiting. Accordingly, in 1939 a gas oil stripper was added to the topping side of the combination unit. This, together with other minor modifications and additions to provide more crude pre-heat, brought capacity to 10,000 b/d. Shortly afterwards, a new column and several side strippers were added to permit production of special boiling point naphthas.

During the early part of 1940, a UOP non-selective polymerization unit was installed to polymerize the cracked C_3 and C_4 fractions recovered in the stabilization plant. Since the existing stabilizer was overloaded, a new thermal gasoline stabilizer was added at the same time to recover the feed for the new polymerization unit. The old stabilizer was used to separate residual propane and butane from the polymer.

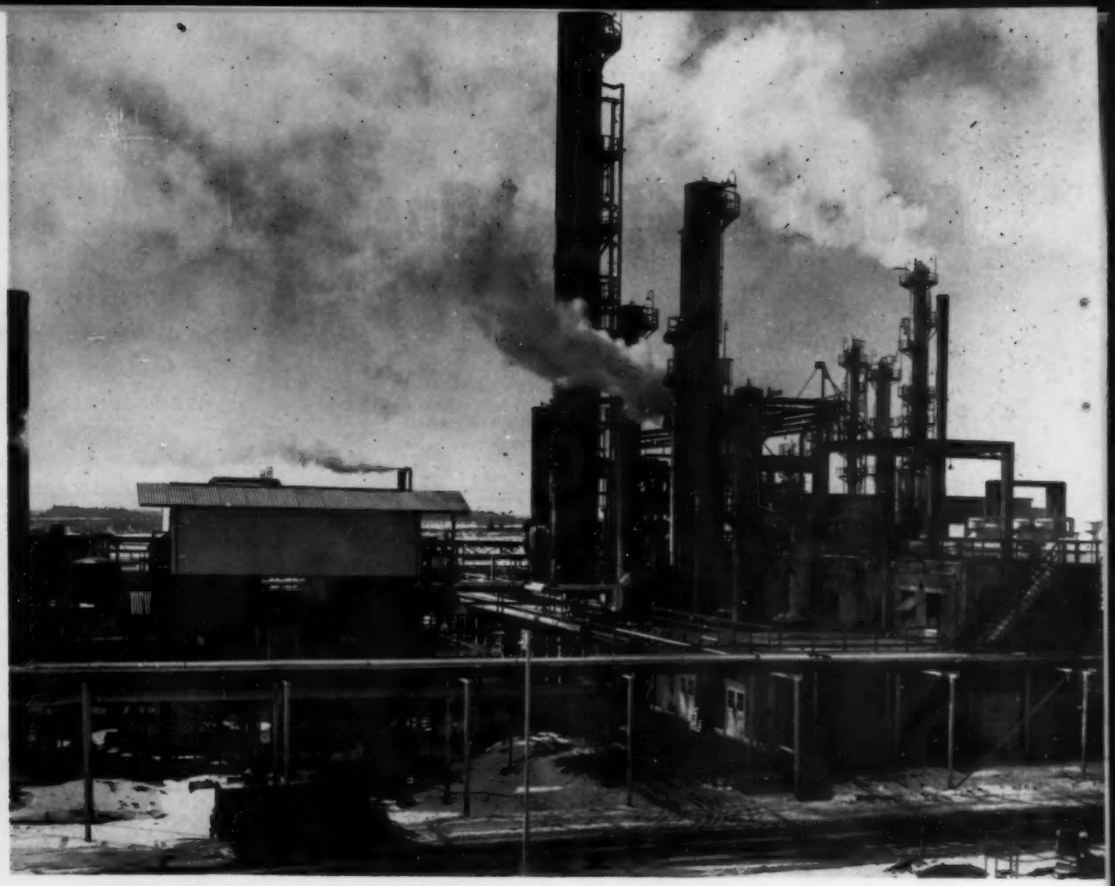
With the outbreak of the second world war, the chief task of the Canadian petroleum industry became the supply of petroleum products for industry and the armed forces. To assist in the critical aviation fuel supply problem, Shell's polymerization unit was quickly converted to the production of cumene and became the first plant to produce this material in Canada. Refinery propylene and purchased coal tar benzene were the feed stocks.

While the production of cumene contributed in no small way to the volume of aviation gasoline produced in Canada, the chief component in aviation gasoline, alkylate, was critically short during the early war years. The American petroleum industry was at this time expanding its strained alkylation facilities as quickly as

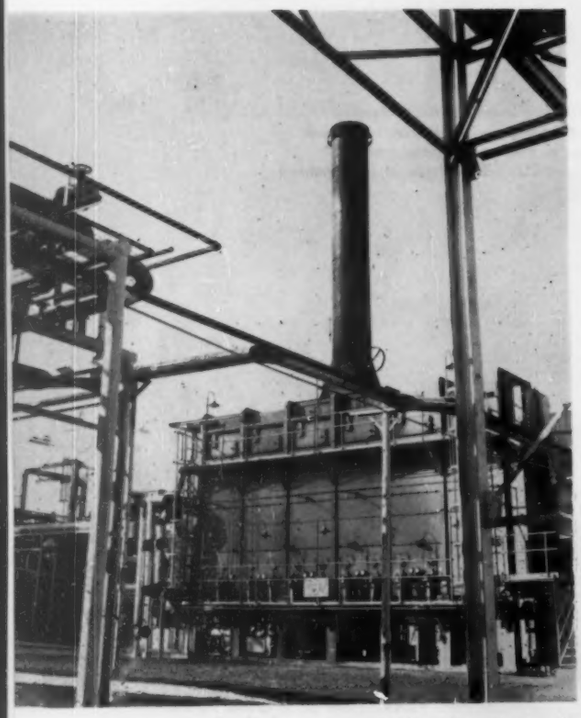


(2B) View today. Enlarged office and boiler house, with new cafeteria, warehouse and laboratory buildings in background.

(2A). View of original office, pumphouse, boiler house, and Dubbs combination unit.



3. Alkylation plant converted to today's topping plant.



5. New Born heater in topping plant reboil service.

possible, but it was apparent that Canada would have to provide a source of supply of its own. The Canadian Government accordingly decided to erect a plant at Montreal East where a good supply of butylene feed stock from the four refineries in the area was available. Shell was elected to operate the new project. The plant was erected on Shell property in 1943. Facilities included a Shell liquid phase isomerization plant for conversion of butane to iso-butane and a sulfuric acid recovery plant for the regeneration of spent alkylation acid. At the same time, a new 60,000 lb/hr boiler was added to the steam plant, and a circulating cooling water tower was built, together with extensions of electric power facilities, offices, etc. The plant was operated by a Crown Company staffed and managed by Shell personnel loaned to it for the duration of the war emergency.

With the cessation of hostilities, operation of the alkylation plant proved economically unsound and the plant was shut down and "put in moth balls." Shortly afterwards, all its equipment was purchased by Shell from the Government. The return to peace, and the expanding industrial economy, saw the demand for petroleum products continue to grow. At that time the major refinery bottleneck was the crude topping section of the original Dubbs unit which limited crude intake to 11,000 b/d. Studies revealed that the fractionation section of the idle alkylation unit could be converted into a new topping plant which would allow processing 15,000 b/d of crude oil with improvement at the same time in fractionation and stripping, so that the topped crude could still be processed within the capacity of the Dubbs unit. The new topping plant arrangement was completed by the refinery's own engineering forces in 1948, and made use of nearly all the old alkylation plant towers, pumps, exchangers, cooling water tower, pumphouse, furnace, etc. (Photo 3).

With the new plant on stream, the original topping facilities were shut down for a time; throughput on the new facilities quickly reached 16,000 b/d, limited only by the capacity of the thermal cracking unit to crack the straight run residue produced.

Much of the remaining equipment in the alkylation plant was also reactivated. A design for a Shell Solutizer sweetening unit for thermal cracked gasoline was developed based on utilizing most of the equipment from the alkylation reaction system. This plant was designed and built by Shell's own engineers in 1949 and operation of the old doctor treating plant was abandoned.

In 1951 a further major expansion and modernization program was completed. The project included installation of a new type of fluid catalytic cracking unit incorporating many process and engineering innovations. (Photo 4). The unit is, for example, completely heat balanced, having no feed preheat and no regenerator cooling. All conventional risers were eliminated, only a single riser being employed to raise the catalyst into an external stripping vessel. This arrangement reduced the overall unit height, thereby effecting economies in structure, and it

4. Vacuum flasher and cat cracker, including light ends recovery.

also resulted in low coke yield due to the superior stripping obtained. Other features included swage-shape vessels for improved catalyst-gas contacting, direct oil injection into reactor catalyst bed, and a novel pipe distributor for the introduction of air into the regenerator.

Feed for the catalytic cracking unit is topped crude from the topping units, the original Dubbs topping plant having by this time been reactivated after revamping and modernization. The topped crude from these units is flashed in a vacuum flashing unit to produce a clean heavy gas oil overhead. The latter constitutes the main charge to the catalytic cracking unit. The pitch from the bottom of this unit is now visbroken in the old Dubbs unit.

Other process additions included facilities for gas recovery and separation, and greatly extended facilities for propylene and butylene polymerization. Design rates were:

	BARRELS DAILY
Crude (Light Venezuelan)	22,000
Vacuum Flashing	11,000
Catalytic Cracking	10,000

Throughputs have been steadily increased beyond these figures as bottlenecks were, in time, uncovered and eliminated in present day capacities as follows:

	BARRELS DAILY
Crude (Light Venezuelan)	44,000
Vacuum Flashing	19,000
Catalytic Cracking	16,000

In the case of the crude units, the major throughput limitation proved to be preheat capacity. This was corrected by improvements in crude heat exchange and provision of additional direct-fired heat capacity. (Photo 1-B). In topping unit No. 1, the latter was provided by utilizing one of the old Dubbs furnaces which up to that time had been in reforming service, but now, with current crudes, not an economically attractive operation.

Extensive revisions of topping unit No. 2 undertaken last year by refinery personnel raised the capacity of that plant from 20,000 b/d to 28,000 b/d. Before these revisions were made, all direct-fired heat for the primary column reboil and for secondary column preheat and reboil was obtained from a single heater. This heater—formerly the heat medium furnace in the alkylation plant—has a capacity of 60 MM Btu/hr. In the revised flow scheme, this furnace now supplies heat only to the secondary column. A new Born furnace of 25 MM Btu/hr capacity was erected to provide reboil heat for the primary column. (Photo 5). Other changes consisted primarily of replacement of a number of pumps and exchangers. A very serious bottleneck in capacity of the primary column was eliminated through replacement of bubble trays with the newly-developed Shell turbo grids.

Gains at the catalytic cracking unit have been made possible largely by improving heat balance conditions. This was done by provision of fractionator slurry-to-feed heat exchange. To explain this change, it is necessary to understand that cracked vapors from the reactor must be desuperheated in the bottom section of the main fractionator. Heat is removed from this desuperheating section by circulating a stream of oil/catalyst slurry

(Continued on page 137)

6. Crude vapor heat exchangers at vacuum flasher.

Launchways at Point LaBarbe extended approximately one-half mile inland, requiring extensive clearing and filling.

Crossing of the Mackinac

By Joseph S. Troxell*

CONSTRUCTIONWISE, several new records were achieved in building the Mackinac link of the Lakehead Pipe Line Company's 643-mile extension that will now permit the first year-'round "winterproof" flow of Canadian oil to a good part of the Great Lakes district. According to all reports, the twin 20-inch diameter crude oil submarine lines that now span the bottom of the straits are:

1—The longest (four miles) and deepest (up to 252 feet).

2—The deepest ever laid by the "pull method." The previous record: 110 feet beneath the Narrows between Brooklyn and Staten Island. While one of the most costly under-water crossings ever attempted (total cost, approximately $8 million), the lines that now link Northern and Southern Michigan beneath the Mackinac saved many times their outlay. The shortest alternate route would have required almost 100 miles of additional pipe line and entailed serious and expensive right-of-way problems in the suburban areas of Chicago.

The Mackinac Crossing is a key link in the $76 million, 643-mile, 120,000 to 300,000 barrel a day extension built by nine contractors from Superior, Wis. to Sarnia, Ont., under the supervision of the Bechtel Corp. as agent for Lakehead. Lakehead's original line hooks up at the border, near Neche, N. D., with that of its parent organization, the Interprovincial Pipe Line Co. Year-'round transmission is now possible from Edmonton, Alta., to Sarnia.

Every conceivable construction problem was faced by the contractors. There were 47 railroads, 46 highways and 45 river crossings; 100 miles of swampland; 140 miles of heavy forests and the Straits of Mackinac between Lake Michigan and Lake Huron.

The final decision as to the route rested with a five-man coordinating committee. It consisted of R. E. Trammell, Lakehead general manager; F. J. Stubbs, assistant general manager; R. H. Clute, chief engineer; Van W. Rosendahl, senior vice president, Bechtel; and R. L. Hamilton, pipe line consultant, Bechtel.

The Straits are four miles wide at the point selected for the Crossing. The underwater slope was gentle for two miles out from the southern shore. A mile off the northern shore, however, Merritt-Chapman & Scott engineers found a 252-foot deep glacial gorge, with red clay sides and bottom, that had been gouged out during the Ice Age. Even the "gentle" slopes close ashore presented a problem. In winter, drift-ice piled up along the shores and left debris on the bottom. Thus it was decided to trench the lines out to a depth of 65 feet to avoid winter mishaps and to anchor it securely.

It took seven months—from February to September '53—to plan and carry out the delicate twin crossings, but the pull-

* Project Manager for Merritt-Chapman & Scott Corporation.

ing of the lines took only 233½ hours. In fording the straits, pipe liners called into play all the technological advances of modern science to pinpoint 1,760 tons of pipe in a straight line at depths up to 42 fathoms under the often turbulent waters. X-ray equipment and "super-hot" cobalt pills were used to check the welds. Electronic devices bounced signals off the straits bottom to trace the rock, clay and running sand. A 16-station radio and telephone network was established for 'round-the-clock communication, and a complete weather reporting service was instituted to keep constant watch on wind and water conditions.

Every possible precaution was taken to insure that all would go well with such a precarious amphibious adventure:

1. Pipe of unusual ductility, with a 13/16-inch wall, was selected. The pipe had to be sufficiently heavy to obviate the need for additional ballast and pliable enough so that it could "snuggle" smoothly to the bottom's uneven contours.

2. A carefully mapped system of mandrels and pontoons was devised to provide low negative buoyancy for both pulling cable and pipe.

3. Facilities were provided to give the pulling cable vertical as well as horizontal pulling power to keep it from burying itself (and the pipe) in the bottom.

Work was begun in the dead of winter, 1953. Time was to be a tough taskmaster throughout the operation, for the lines had to be laid and ready for use before the customary early freeze that hits northern Michigan and which, in the past, always had forced oil carrying tankers into port five months a year. The February cold was used to advantage. Survey parties made borings through the ice to chart and determine the profile of the rugged floor and nature of the materials.

Working out from Point LaBarbe, near St. Ignace, on the northern shore, and from McGulpin Point, near Mackinaw City, on the Lower Peninsula, a series of sighting towers was built at the first flush of Spring. They were used to indicate the survey line and determine lake bottom contours. The towers varied in height from 25 feet ashore up to 130 feet in the water, with approximately 25 feet showing above the surface.

A flat, swampy area had been selected at Point LaBarbe for the launchways. Grading crews, using chain saws and dozers, cleared away a dense growth of trees and brush. The ground was leveled, and enough rock and granular material was hauled in to make a stable base on which the launching equipment could rest. The ways were to extend inland from the lake shore approximately one-half mile.

At the far inland end of the launching ways on anchorage was built for the hold-back winch. On the McGulpin Point side a concrete foundation for the powerful steamwinch, the puller, was embedded in rock on a bluff approximately 2,500 feet from the water's edge.

Preparatory work, meanwhile, went forward on the straits itself. To prepare the trench, in which the lines were to rest in depths up to 65 feet out from the shoreline, Merritt-Chapman & Scott assembled the largest fleet of its kind ever seen on the Great Lakes. The dredging armada included four clamshell dredges with four and one-half yard buckets, two dipper dredges, of nine and 12-yard capacities, a 26-inch hydraulic dredge, a drill boat, six dump scows, seven tugs, and five work boats. To handle the traffic and protect the floating equipment against the storms for which the Lakes are noted, it was necessary to construct a temporary harbor, docks and causeways.

Dredging of the 5,000-foot trenches extending from either shore was started on May 15. As was the case throughout virtually every phase of the operation, rough "seas," fog and rain balked all efforts at 'round-the-clock work. It was extremely important to keep the dredges on exact alignment—not only to avoid disturbing a vital submarine telephone cable which lay between the pipe lines, but to keep the pulling cable in true line. An elaborate system of cut-off ranges marked off the distances, and powerful, fog-penetrating electric range lights helped the dredges stay in line.

The first 1,000 feet of trench from each shore ran through solid rock, the remaining 4,000 through sand. At about 5,000 feet from each shore, the water reached depths of 65 feet or more, and no further trenching was required. Some dredging was required in the middle of the straits, at depths of 200 feet and more, to remove the humps of red plastic clay which otherwise would have created an excessive strain on the pipe.

All dredging calculations were made from sonic sounding charts—an important development in the laying of submarine pipe lines. The trench in sand and in rock was nine feet deep, providing a minimum of 15 feet covering in the sand areas. One million 300 thousand cubic yards of spoil were dredged; some of it was used to build the temporary harbor, but most of it was loaded into scows and dumped into deep water. Some of it was used later for backfilling.

The 26-inch hydraulic dredge did the first honors, cutting a channel 20 feet deep and 250 feet wide through a sandbar about 2,000 feet off-shore from the launching ways. The 26-incher then deepened to 20 feet an area between the trench and nearby island to provide a sheltered harbor.

Laying of the pulling cable across the Straits' bottom was perhaps one of the most critical operations of the project. To assure the later success of the pull itself, it had to be laid absolutely straight in the trenches and across the exposed bottom of the straits. Each of the two cable laying operations took three days. Starting from the southern shore, the derrick barge Cherokee successively laid out eight 2,500-foot sections of two-inch

With 30 pontoons riding piggy-back at approximately 80-foot intervals, a 2,500-foot section of pipe line is ready to be pulled into the water.

First of the pipe line's eight 2,500-foot sections nears the water at the launching site on the St. Ignace side of the Straits. The pulling cable is attached.

wire rope cable. Every other joint of the four-mile sectional cable was equipped with a swivel to take out the twist. To keep the cable from burying itself in the mud of the bottom, it was fitted with positive 1,400-pound buoyancy mandrels at each joint.

In laying the cable out from the twin 50-ton capacity winches on the south shore, the Cherokee was aided by a fleet of tugs and three floating derricks, which moved and set the anchors used by the Cherokee to winch herself across the straits. The Cherokee utilized five 20-ton concrete mooring blocks, two of which were off the port side, two off the starboard side, and one off the bow. By hauling in on these anchors with her winches, the Cherokee was literally pulled across the rough straits on her own bootstraps.

As the Cherokee moved forward, the two-inch rope pulling cable was reeled out. The two whirley derrick barges, on either side of the Cherokee, advanced the mooring blocks to new positions as the cable laying operations moved along. Every 650 feet, the Cherokee carefully aligned itself with ranges and by transits on shore, and pulled the two-inch rope taut to straighten it.

Meanwhile, at the launching site, the ways were built and the long gray sections of pipe readied for their cold plunge. Rubber-tired launchways, spaced 45 feet apart, were positioned. They consisted of a series of small cradles of three pneumatic tires which would turn freely as the pipe was pulled over them and into the water. A pivot at the center of the launcher enabled it to tilt see-saw fashion, stabilizing the line as it was moved toward the water. A floating launcher was positioned at the water's edge to transfer the pipe into the trench from the shore ways.

Alongside the ways, 27-foot lengths of pipe were welded together into 2,500-foot sections and X-rayed with a super hot cobalt pill. Extraordinary precautions were taken to protect the working personnel and spectators from radio-activity. Large upright lead shielders were set in place on both sides of the welding station, and everyone was evacuated from the surrounding area. The highly radioactive pill, carried in a special protective container in the back of a jeep, was backed in behind the lead shields. With everyone at a safe distance, a technician opened the container with a six-foot long rod, extracted the pill, placed it onto its holder, already in place on the pipe, and ran from the "hot" area. Technicians, armed with Geiger counters, ranged the edge of the area, issuing warnings when necessary.

As in the case of the overland sections of the pipe line, the Straits pipe was coated and wrapped with fibre glass. A coat of whitewash was applied to minimize the heating effects of the sun as the sections lay on the ways awaiting launching. To provide additional protection for the pipe as it was pulled across the bottom, one-third of its exterior was sheathed with 1 x 3-inch lagging, held in place by metal bands.

Side-boom tractors lifted the 2,500-foot sections atop the rubber-tired launchways. Using ordinary belt pipe slings, the tractors "leap-frogged" around one another down the length of the pipe.

Thirty-eight cylindrical steel pontoons were saddled atop each pipe section at approximately 66-foot intervals. Held in place by steel bands, each provided 1,770 pounds of net buoyancy. The 341 pontoons used in the operation were pressured with 80 pounds of air.

Smaller cylindrical 60-pound buoys were placed atop the pontoons. A continuous tripping line—a "rip-cord"-like contraption—permitted the buoys to be cut loose consecutively from the shore once the pipe line had been pulled across. As the buoys came to the surface, each brought with it a tripper rope, connected to the larger pontoon. The latter was then cut loose from the pipe line by pulling the tripper line from the surface.

The pontoons reduced the negative buoyancy of the pipe from 32 to six pounds per linear foot. That was enough to send it to the bottom, but eased enough of the otherwise completely deadweight strain on the pulling engine. In a floating position, the pipe line would have been exposed to wave action and other surface weather conditions and would have interrupted water traffic. Marine traffic continued without interruption throughout the entire pull, though ship routes were slightly altered to avoid possible collision with floating equipment.

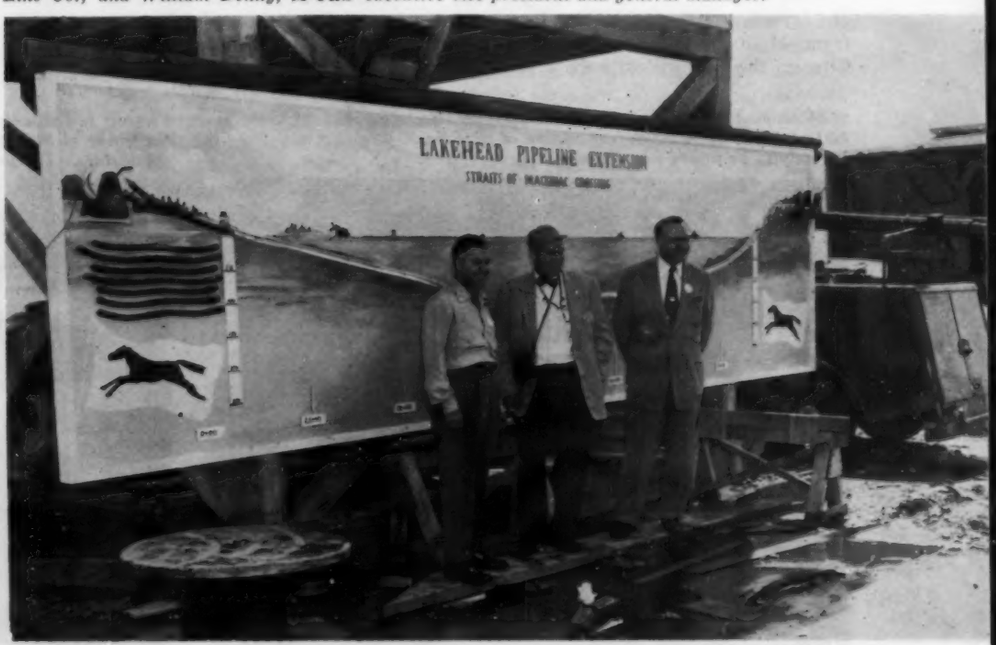
On the Mackinaw City side, the pulling cable which had been laid across the straits was shackled to a wire rope cable leading to the pulling winches embedded on a bluff about a half mile from the shore. On the St. Ignace side, it was shackled to a pulling dome welded to the forward end of the first 2,500-foot section of the pipe line. The pulling cable hooked into the lower of two holes in the dome. A two-inch cable running to a winch mounted aboard the "Cherokee" was shackled to the upper hole in the dome.

The inshore end of the first 2,500-foot section was fitted with a hold-back dome, in which was fitted a sheave. A cable was run through the sheave, and was shackled to a deeply-entrenched deadman 2,700 feet from the beach. The hold-back was necessary to keep the pipe line in tension during the pull.

The operation called for the pulling to be stopped when each 2,500-foot section of pipe line had been pulled almost completely into the water. On the St. Ignace side, a temporary hold-back cable was attached to the pipe line forward of the hold-back dome at the end of the pipe. Once this temporary hold-back cable had fully taken up the strain, the regular hold-back cable was removed and the dome cut from the pipe.

A second 2,500-foot section of the pipe line was then lifted aboard the pipe launchers and welded to the inshore end of the first. The hold-back dome was then

"Sidewalk superintendents" flocked to the scene of the Straits pull, and hailed the arrival of the pipe on the Mackinaw City side. Appreciating the public interest in the spectacular crossing, Merritt-Chapman & Scott erected an animated billboard diagramming the project; it kept the spectators posted on the pipe's underwater progress. In front of the board, left to right, are: Sherman Serre, Merritt-Chapman & Scott vice president in charge of Great Lakes marine and heavy construction division; Tom S. Johnson, president, Lakehead Pipe Line Co.; and William Denny, M-C&S executive vice president and general manager.



welded to the inshore end of the second section. As the hold-back cable again took up the strain, the temporary hold-back cable was disconnected and removed from the first section. This process was used throughout the entire pull.

The original plan called for a two-drum winch to haul the pipe across the four-mile wide straits. When all but 50 feet of the initial 2,500-foot section had entered the water, one of the drum shafts snapped, however. Tractors were pressed into service, and they pulled the first pipe section the remaining distance into the water. Then the second drum broke. At this point the Johnson steam winches were set up and finished the first pull and handled the entire second pull.

The barge "Cherokee" also helped with each pull. It moved 1,000 feet ahead of the pipe, taking in and slacking out on an emergency cable to adjust for the elevation of the pipe head.

Direction of the pulling operation was centered in a central control tower that had been erected on the water's edge close to the launching site. It was from this station that all directions were radioed or telephoned to the winchmen on both sides of the Straits and to key personnel afloat and ashore.

Weather and water condition information was fed to the control station from various points on the Straits. A weather station kept the project's "nerve center" informed at all times of wind direction and velocity and major factors in water current. An automatic water gauge also gave continuous readings of water elevations.

Borings through the ice to determine the profile and material across the entire Straits were made in February.

"Old Bullhead," the pulling dome, and the long gray pipe, with pontoons riding piggy-back, were met on the Mackinaw City side by loud whoops and cheers. Amid triumphant shouts, executives and employees of the construction companies cracked a bottle of champagne on "Old Bullhead."

The two crossings took 233½ hours in actual pulling time. The first line was launched from the north shore at 2:38 AM August 9, and touched the south shore at 8:15 PM August 15. The second line was launched at 4:00 PM September 17, and the pull was completed at 9:05 AM, September 20, 1953.

When each pull was completed, a unique method was called into play to test the line and settle it firmly on the bottom. A four-inch filler line was inserted into the 20-inch pipe from the St. Ignace side. Welded into 2,000-foot sections that were successively coupled as it was inserted, the four-inch line reached 5,600 feet into the "Deep Inch" so that its head eventually was at the deepest point of the crossing.

A testing head was welded to the pipe's open end and, by means of the filler pipe, the 20-incher was slowly filled with water. This technique permitted the pipe to be filled from the deepest point, eliminating "air pockets."

Furthermore, as the pipe was still supported by pontoons, and consequently resting gently on the bottom, the slack necessary for perfect bottom conformation was properly drawn from each end.

After the line had been filled, it was hydrostatically tested at 1,200 pounds per square inch, and held for six hours. The test was perfect, and upon completion, sonic soundings were made to verify the final location and depth of the pipe line just prior to removal of the pontoons.

Backfilling on the completed lines was done immediately after the test. It consisted of a 15-foot cover in the 17-foot deep trench from either side out to the 65 foot contour line. For that portion of the line lying in deeper water, a new method was employed. At maximum 1,000-foot spacings, 40-50 foot long fill sections were placed at right angles to the pipe. This procedure minimized the scouring effect of the Straits' swift current. The western line was completed in mid-August 1953. The eastern line was laid a month later. Oil began flowing in mid-December.

Led by mandrel and pulling dome, the front end of the pipe line, with pontoon atop, comes out of the Straits water and is pulled into the shore at Mackinaw City. To a depth of 65 feet, the line, in a 17-foot deep trench, was covered with 15 feet of fill. For that portion of the line lying in deeper water, a new method was employed to minimize the scouring effect of the Straits' swift current. Sections of fill 40-50 feet in length were placed at right angles to the pipe at maximum 1,000 foot spacings.

At a Socony-Vacuum Oil Company advance camp at Loon Lake, bulldozers pull in skid-mounted trailers for living and working quarters and hack out roads and drill sites.

It's 50 below zero in Peace River Valley, a cold time to take any unnecessary strolls. Socony-Vacuum photo.

Airport at Calgary, Alberta, where thousands of oil men land each year to visit the many company headquarters for operations in the province. Photo by Anthony Linck for Cities Service Co.

Alberta completes active year

By J. L. Irwin

ALBERTA PRODUCED 76,818,432 barrels of crude oil in 1953, an increase of nearly 18 million over 1952. Output was 94.96 percent of the Dominion total. The revenue obtained from sales of crude oil and natural gasoline established a record of $195,864,381, which works out to an average of $536,615 daily to compare with $386,121 per day in 1952.

The cumulative total for Alberta's crude oil production from 1914 to 1953, inclusive, now stands at 337,581,327 barrels. Cumulative valuation total for sales covering this 39-year period is $908,477,026. Daily valuation average for December 1953 was $650,868.

The steady expansion of established major fields, together with the introduction of promising new ones, resulted in the large production increase at the close of the year. The following table gives production totals for the past two years of the 12 leading Alberta fields.

TWELVE LEADING ALBERTA OIL FIELDS IN 1953

Field	*1953 Barrels*	*1952 Barrels*
Redwater	23,281,596	23,975,841
Leduc-Woodbend	21,362,524	17,839,209
Bonnie Glen	5,550,715	743,490
Armena-Camrose	3,257,720	1,307,526
Wizard Lake	3,095,287	1,696,077
Acheson	2,497,850	2,016,855
Turner Valley	2,404,967	2,655,007
Golden Spike	2,167,636	1,279,103
Fenn	1,412,996	343,766
Joseph Lake	1,286,736	1,001,843
Excelsior	1,060,555	933,644
Lloydminster	1,059,552	1,057,354

In the preceding list it will be noted that Redwater last year had a lead over Leduc-Woodbend of only around two million barrels. Redwater led by about six million at the close of 1952. Leduc - Woodbend may take the ascendancy by the end of the current year.

The increase of Bonnie Glen is outstanding. Armena - Camrose and Wizard Lake are also well deserving of notice. Turner Valley's annual decline is still not very serious. At the end of 1952 it was about 300,000 barrels to compare with the decrease last year of around 250,000 barrels. Production at Fenn showed a large increase.

Many new fields, starting late in the year, showed considerable promise for 1954. North Big Valley, West Drumheller and Westerose, all later arrivals, in particular gave satisfying results. Some of the older fields improved, such as Wainwright, which more than doubled its production in comparison with the previous year.

The two discoveries, coming late in 1953 — Sturgeon Lake, some 80 miles south of Peace River town and 175 miles northwest of Edmonton, and the great area at Pembina - Buck Creek - Minnehik Lake, about 65 miles southwest of Edmonton—are producing on a major scale with their first wells. Sturgeon Lake's production is from the Devonian D3 reef. The Pembina recoveries are light oil from the Cardium, Belly River, Viking and Basal Blairmore sands. The last well also reported two oil zones in the Devonian D3 reef. Wells recently completed in the Rimbey, west of Lacombe, and St. Albert, just northwest of Edmonton, areas are also in production on a major scale.

It is quite possible that present predictions of nearly 100 million barrels in oil production for the present year of 1954 may be realized for Canada. This would mean a daily average for the year of around 275,000 barrels.

There were 4,000 operating oil wells in Alberta at the close of the year compared with 3,312 wells a year earlier. Shut-in wells totaled 504, compared with 347 in 1952. Wells by fields or areas are as follows:

	Dec. 1953		*Dec. 1952*	
FIELDS OR AREAS	OPERATING	SHUT IN	OPERATING	SHUT IN
Acheson	102	2	95	3
Armena-Camrose	268	11	173	3
Bonnie Glen	92	1	18	0
Golden Spike	15	0	11	0
Leduc-Woodbend	1,173	70	1,037	46
Lloydminster	186	174	216	101
Redwater	902	24	906	20
Turner Valley	276	50	284	45
Wizard Lake	47	1	32	0
Other Fields	868	131	520	109
Other Areas	71	40	20	20
Total Oil	4,000	504	3,312	347
Total Gas	272	133	245	117

Drilling licenses issued during 1953 totalled 1,467 compared with 1,729 in 1952. New oil producers brought in totaled 884, compared with 946 the previous year. Gas producers totaled 53, compared with 38. Footage drilled was 6,422,889, a decrease of 3.2 percent from the 6,631,529 feet drilled in 1952.

Natural gas production for 1953 totalled 113.9 billion cubic feet to compare with 95.8 billion for 1952. The principal fields producing natural gas in Alberta during 1953 were Pakowki Lake, Jumping Pound, Leduc-Woodbend, Medicine Hat-Redcliff, Turner Valley, and Viking-Kinsella-Wainwright. These fields were responsible for just over 75 percent of the year's gas production total, the balance being contributed by other fields or areas over a wide area.

Natural gasoline production totaled 602,368 barrels valued at $1,745,887 in 1953 compared with 579,873 barrels valued at $1,662,514 in 1952. Producing plants are operated at Jumping Pound, Leduc-Woodbend, and Turner Valley. Alberta produced 445,722 barrels of propane and 198,401 barrels of butane, both largely increased over the 343,372 and 140,228 barrels (respectively) produced the previous year. Sulfur produced from natural gas was more than double, rising from 8,931 to 18,298 short tons.

Despite the greatly increased oil production of last year, problems in the latter part of 1953 arose which were responsible for decreasing the pace of exploration and development in Western Canada.

Middle East oil reaching the Pacific Coast at reduced tanker rates lowered hopes for the time being of a substantial market for Trans Mountain's pipe line. This, plus continued uncertainty as to markets for Alberta's surplus gas, constituted the principal factors which created these problems. Both of these situations now look more favorable. Progress in developing outlets for gas is discussed elsewhere in this issue.

Outlets for Alberta crude will be improved this year by the completion of new refinery capacity on the Pacific Coast and an increase of capacity of the Interprovincial line and the Lakehead extension to Sarnia. Capacity of the line will rise from around 170,000 to 215,000 barrels daily late this year. Contracts for the work to be done have already been awarded, it has been announced by the company. The looping program covers 454 miles of the 24-inch pipe to be laid in Canada, and 184 miles of the 26-inch to be laid on the American side of the line in Minnesota.

The network of pipe lines throughout Canada (crude, oil, products and gas) has been detailed in earlier reports. With Alberta's outstanding ascendancy in 1953 as to general oil development, however, a mention once again of the smaller pipe lines in that province might be in order.

Optimistic views of the future of the Pembina area were given in a recent hearing on the application of three groups desiring to build a gathering line to the new field. Reserve estimates ranged from 762 to 953 million barrels.

Estimates of producing wells in the area by 1960 were given from 2,500 to 3,000. By 1957, estimated production from the area for about 1,000 wells was given at around 75,000 barrels daily.

L. C. Stevens, vice president in charge of production for Socony-Vacuum Exploration Co., stated in giving evidence before the Board that the Pembina field may one day compete with California oil in its home state.

Continuing, Mr. Stevens stated that a market existed on the West Coast, and that it was the general desire to start supplying it by September or October. The British Columbia-Washington-Oregon market, he said, was good for about 300,000 barrels daily, and the Trans Mountain Pipe Line was designed for about 300,000, and may have to be enlarged.

With saturation point reached in the Prairies, Ontario and British Columbia, and with still a surplus of crude oil, "we should try to reach out to further markets, and we must take a cut in the price of common crude."

This would mean a cut in Pembina crude "so we will probably be able to get into the California market" where the state is now importing, as it is unable to produce enough for its own needs.

In conclusion, he remarked that Socony was already piping Pembina crude to the West Coast via the Trans Mountain Pipe Line at a rate of 1,500 barrels a day.

Drayton Valley, accessible by a good gravel road, and situated 37 miles south of the Jasper Highway, is destined to become the seat of activities for the northern area of Pembina.

Further to the north and west lies the Chip Lake-Mayerthorpe-Whitecourt general area, which is also receiving much attention at the present time on the part of some of the majors and strong independents.

Attention is being shifted from the plains to the Alberta Basin and the Foothills belt. The demand for lands in this area to the west is growing quickly as a result of the amazing story of Pembina, the size of its productive area, and the existence of its varied pay zones.

Further to the southwest, the Nordegg area, which produced some major gas wells about 20 years ago, is booked for further development.

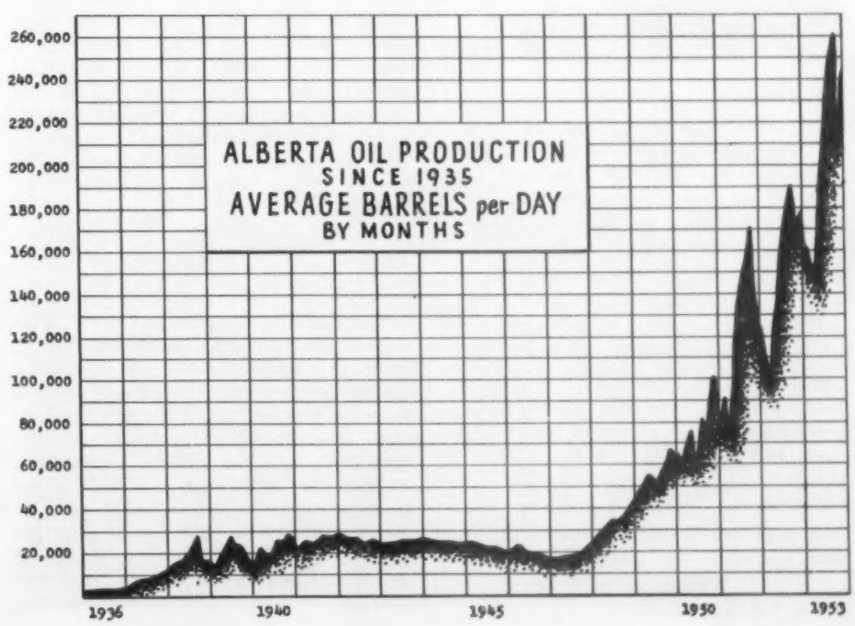
The trend is now westward. Exploration costs will be increased because of greater depths, but rewards for success will be more substantial.

Activity in southern Alberta will be stimulated when the proposed Trans Canada gas line gets under way.

Trans Empire Oils has a large reservation in the Princess area, and wells will be drilled there which will seek gas for supply to the line.

Century Oils, also with a large reservation in the Scope area, will follow up its recent dual gas success there in the Milk River and Bow Island sands (established by the Calcana-Century-Monarch team) with a second well as soon as road bans are lifted.

Other companies in surrounding areas will no doubt have similar programs, and drilling activity over a wide area is anticipated.



Saskatchewan

oil and gas developments

Robert Pot, a native of Holland, graduated in 1932 as a chemical engineer and took a post graduate course in gas engineering. For four years he worked in the production end of a coal gas plant in Holland. He then joined the Shell Group in Venezuela where he served for six years as a petroleum engineer. In 1943 he was transferred to the United States to work for Shell in conjunction with the Netherlands East Indies army oil program, going in 1945 to Borneo for a year to assist in the rehabilitation of the oil fields there. In 1947 he joined Imperial Oil Ltd. in Calgary as chief petroleum reservoir engineer, which position he held until 1951 when he became a partner in the newly-formed consulting firm of Trafford & Associates Ltd. in Calgary, Alberta.

By R. Pot

FOR A GOOD MANY YEARS, oil activity in Saskatchewan was restricted to the Lloyminster heavy crude area. The first sizable oil discovery outside of this region was the Coleville field, where heavy crude was found in the Banff sandstone in 1951. This success proved a great stimulant to the industry as a whole, and exploration was stepped up considerably in 1952 with highly satisfying results.

Heavy crude strikes were reported in Buffalo Coulee, Hoosier and Cantuar; and medium crude in Fosterton, Success, Midway, Gull Lake, Eastend and Wapella. The first light crude indication was found in Ratcliffe, where the Mississippian limestone yielded 31° API gravity crude at a depth of some 6,300 feet. Gas strikes were reported in Brock, Smiley, and Battle Creek. Although none of the oil strikes could be classified as "major," the increased frequency of individual discoveries was significant and held great promises for Saskatchewan's oil future. The year 1953 has proven to be even more eventful.

Development of 1952 and Earlier Strikes

The Lloydminster area took a new lease on life with the increased desirability of its heavy crude through the extending market for railway fuel oil, diesel fuel and kerosine for jet fuel. A good many new wells were drilled and extensions to the field were indicated in several directions. In December 1953, more than half of the produced wells in Saskatchewan were located in this area (283 out of 462) for over 40 percent of the total provincial production (133,000 out of 306,000 barrels).

Development in the Coleville - Buffalo Coulee area was restricted mainly to Buffalo Coulee. The heavy crude in this area had no ready market since it does not lend itself to pipe lining. A partial solution was found in the construction of a topping plant at Coleville with an intended capacity of 5,000 barrels per day to yield acceptable refinery charge stocks. Some 76,000 barrels were produced from 89 wells in this area in December 1953.

The medium crude area in which Fosterton, Cantuar, Success, Midway and Gull Lake are located was developed steadily in order to build up sufficient production capacity to supply 10,000 barrels and more per day for a pipe line to connect these fields with the Interprovincial pipe line. Only a small portion of the capacity could be absorbed by local refineries (1,300 b/d in December 1953).

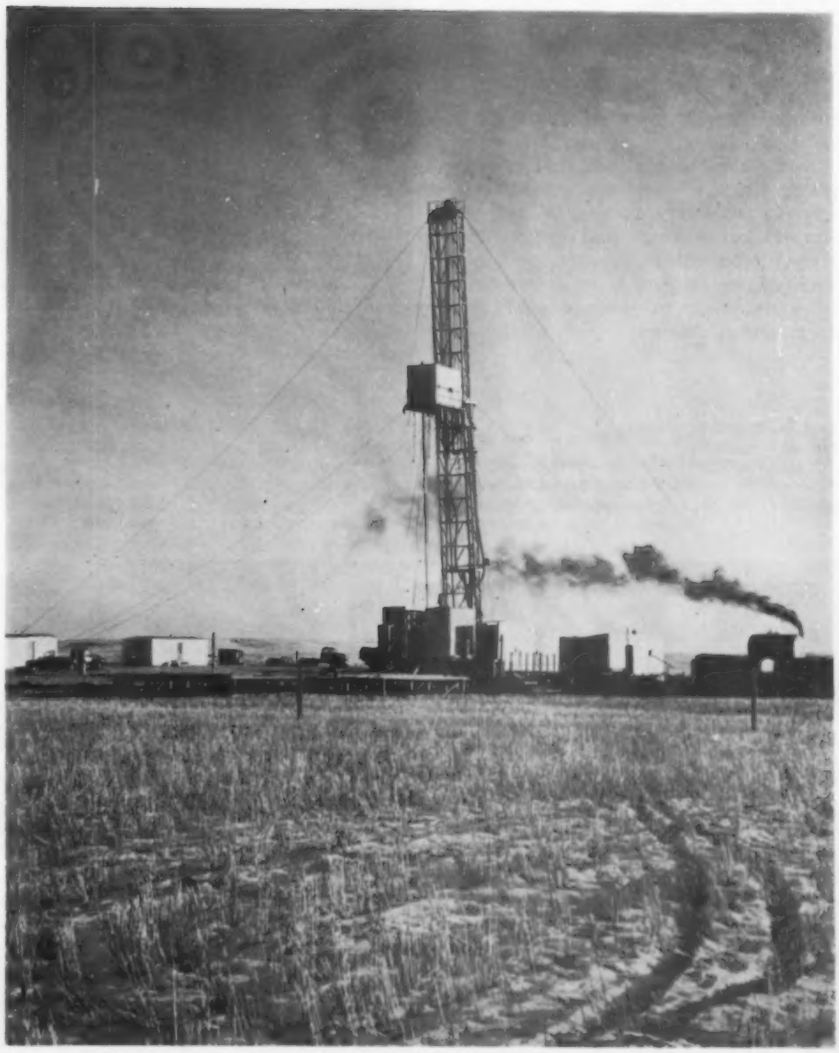
Eastend, a 1952 medium oil indication in the southwest corner of Saskatchewan close to the U. S. border, was not developed although several medium oil strikes were made close by.

The first light crude discovery in Saskatchewan, Ratcliffe, in the Saskatchewan part of the Williston Basin, was a disappointment. Two wells are presently producing and both produce over 50 percent water and little oil.

The Wapella medium crude discovery, also in southeastern Saskatchewan, was developed into a sizable field with 16 wells which produced a total of 16,000 barrels in December 1953.

As far as gas field development is concerned, the first large scale gas project was started in the Brock gas field when 102 miles of 10-inch pipe line to Saskatoon were completed. In December 1953 some 202 MMcf of gas were produced from nine wells.

Socony-Vacuum well drilling in the Fosterton area of southwest Saskatchewan, where Socony-Vacuum found first medium-gravity oil in commercial quantities in the province.



General Progress — 1953

A good measure of the progress and increased activity in Saskatchewan during 1953 can be found in the figures for capital outlay during the last few years. Some $10 million was spent on exploration and development in 1950, $20 million in 1951, $50 million in 1952 and almost $60 million in 1953.

A total of 674 wells were drilled and completed in 1953. Of these, 276 were completed as oil wells, 17 as gas wells, 300 were abandoned and 81 had an undetermined status.

Total completions for the previous years were 124 in 1950, 155 in 1951 and 477 in 1952.

The total number of producers increased from 358 in 1952 to 599 in 1953. Potential producers (standing) were 174 and 299 respectively for the two years.

Total footage drilled in 1952 was 1,381,398 feet; in 1953, 2,309,368 feet.

Production for the province in 1953 totalled 2,797,888 barrels of oil and 1,422,128 Mcf of gas compared with 1,696,504 barrels and 1,138,641 Mcf in 1952.

Proved reserves, as of December 31, 1953, published by the Canadian Petroleum Association, amounted to 182,159,000 barrels compared with 124,247,000 barrels at the end of 1952. Only a limited area is assigned to each new discovery even though the committee concerned with estimating reserves may believe that eventually a much larger area will produce. In its report, however, the committee is concerned only with actually proved reserves.

On the basis of some 60 million barrels of newly proved reserve in 1953, a few statistical parameters can be shown for

(Continued on page 186)

E. A. Smith, manager of manufacturing for Canadian Oil Companies Ltd., is a veteran refiner who started work in the National Refinery Co. laboratory at Findlay, Ohio, in 1915. He was transferred to Canada in 1919 and rose to be superintendent of the Petrolia refinery in 1936. When National sold its Canadian properties to the Canadian Oil Companies, Ltd. in 1939, Mr. Smith was appointed general superintendent. Early in 1951 he was made manager of manufacturing to organize and act as supervising engineer during the period of design and construction of the new refinery at Sarnia and the grease plant at Montreal. He went to the general offices at Toronto in 1952 to organize and head up the new manufacturing department.

New lubricating oil and grease manufacturing plant of Canadian Oil Companies Ltd. nearing completion at Montreal.

NEW

blending and packaging systems feature Montreal oil and grease plant

By E. A. Smith*

THERE IS A GENERALLY accepted statement to the effect that processes and manufacturing techniques in the petroleum industry change so rapidly that frequently, between the time new plants are conceived, designed and built, they are out of date or have become outmoded by new knowledge and methods. Necessity, being the mother of invention, plays a significant part.

The refiner cannot lay down rigid specifications for his raw material—crude oil. He must accept it as it comes from Mother Earth and select his processes and develop techniques best suited to the raw material. He must also anticipate that the raw material itself will change in character and temperament from year to year and his capital expenditures and conduct must be gauged accordingly.

Having established his supply of crude oil, selected his methods and built his plant, he must face a constantly changing situation with respect to product acceptance and utilization. Constant and untiring research must be depended on to keep abreast of the seemingly endless demand for new and better products and new applications.

On October 24, 1951, Canadian Oil Companies Ltd. proudly opened a new lubricating oil and grease manufacturing plant at 6016 Notre Dame Street East, Montreal. At this time it was the most modern and efficient plant of its type in existence. Operations had smoothed out and the plant had operated for approximately 18 months when fate decreed that it be almost completely wiped out by a disastrous fire on the 28th of April, 1953.

Heartbreaking though it was to be so rudely shocked and interrupted in its progress, company personnel were undaunted and immediately set out to overcome the misfortune and carry on "business as usual." A temporary steel building was quickly obtained and erected, a portable steam boiler set up, the field storage, which was not destroyed, was rapidly replenished, former obsolete equipment still on hand was moved in, and stand-by space and equipment was made available at the Cherry Street Toronto plant. Committees were formed to develop and coordinate new supply, and in an astonishingly short time, products were flowing to the field to the extent that the interruption was scarcely noticed.

While thousands of tons of debris were being moved away from the site, a new plant started to take form on the drawing boards. In an amazingly short time the transfer from the drawing board took place and the company recently opened the actual plant on about the anniversary of the fire, thus clearly demonstrating that perseverance, devotion to duty, co-operation and hard work will accomplish practically anything.

The former plant had been, to a great extent, designed around a then-existing building, which of course affected the planning and created some problems. Inasmuch as the former plant was almost wholly destroyed, with the exception of the field storage tanks, the new plant has been designed practically from "grass roots." This has permitted the incorporation of new ideas and will result in a more streamlined operation. It is doubtful that anything was ever built that could not have been built better. The new plant may be no exception, but when given the opportunity to rebuild so soon, full advantage can be and has been taken of past experience. Even in the short time between the planning of the former plant and that of the new, so many new ideas have been evolved and so much new equipment developed, that it has been found possible to obtain much more flexibility and speed with much less building and at the same time provide for future expansion. As an illustration, the entire roof and wall structure is such as to accommodate another story, if ever required.

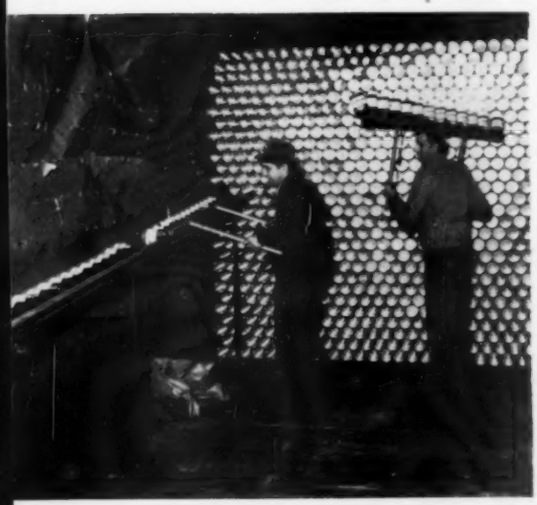
Much attention has been given to working conditions with particular regard for employee comfort and safety. Lighting has been so considered that no room is void of daylight which, assisted by adequate artificial lighting, will result in very efficient overall lighting.

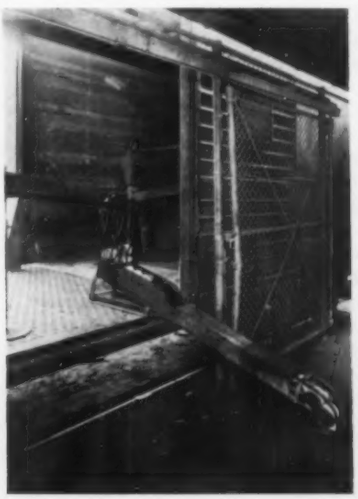
It would be expected that the very best of advice and engineering would be obtained in order to provide the ultimate in fire protection facilities. A new type of sprinkler system has been installed throughout the plant. In the event of fire anywhere in the building, sufficient nozzles go into action and deliver a high pressure spray water fog rather than low pressure spray. The fog is much more effective in extinguishing fire and does not require as much water as the conventional system. The damage from water is also greatly minimized. Plentiful also is the supply of hand extinguishers, nozzles, hose carts and fire engines.

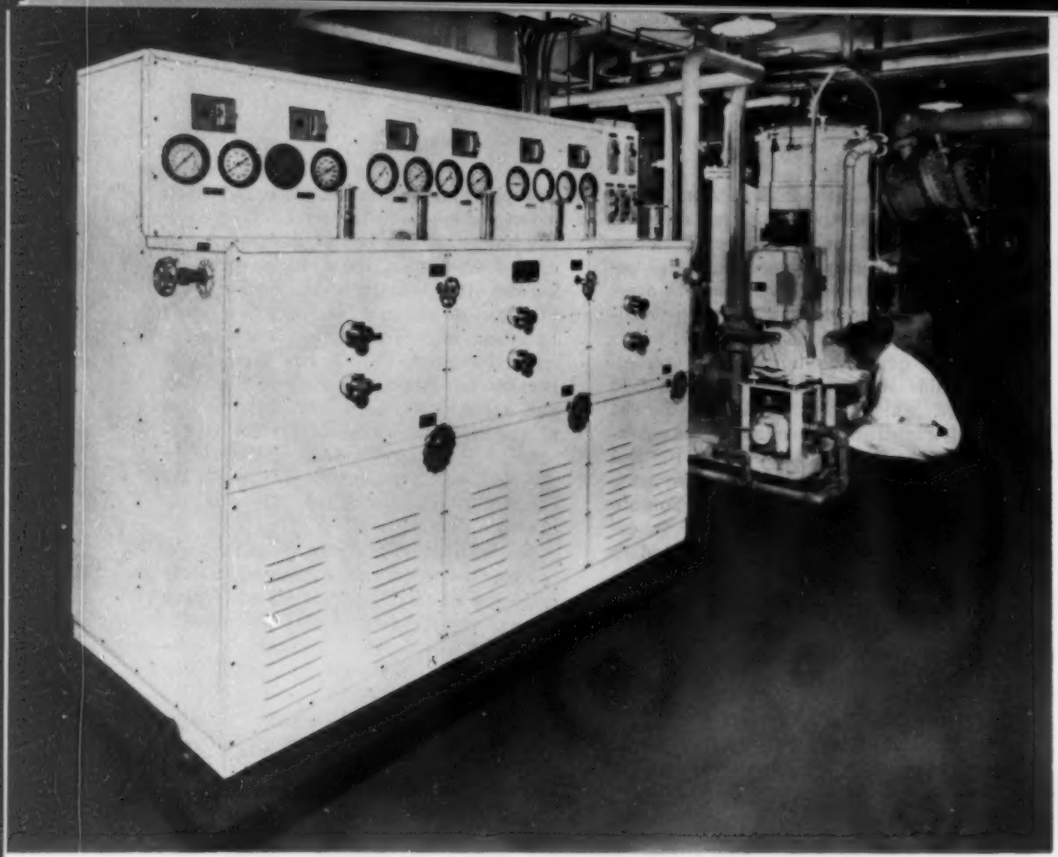
It has been found possible to locate the laboratory more effectually with respect to proximity to the actual compounding and filling operations. This makes it possible to control product quality much

* Manager of Manufacturing, Canadian Oil Companies Ltd.

Left, empty cans are forked to a portable gravity conveyor which is extended sectionally as unloading progresses. Center, cans roll from car to filling line at refinery canning plant. Storage and handling of empty cans is eliminated. Right, cans are cleaned with compressed air enroute and filled before being packed in cartons for storage and shipment. Photographs on this page were taken at the Baltimore refinery of Esso Standard Oil Co. to illustrate the method now being employed at Montreal by Canadian Oil Company and are reproduced here because the Canadian plant was not yet in operation at the time this article was prepared for publication. Pictures at left and right are reproduced through the courtesy of the National Can Corp., center picture courtesy of Esso Standard.







Oil homogenizer being checked before operating in the new Montreal lubricating oil and grease manufacturing plant of Canadian Oil Companies Ltd. Uniform blends are assured by this device borrowed from the dairy industry.

more effectively and with greater speed. Utilization of new high speed laboratory equipment will help to overcome manufacturing time lag, usually occasioned by time-consuming laboratory tests.

Ventilation, always a problem, particularly in plants of this type, has been given preferred attention. When operating gasoline-driven fork lift trucks inside the building, it is necessary to completely change the air very often. Mixing vessels and tanks must be quickly and completely vented of noxious fumes which frequently attend the compounding operation. Nothing is left to chance and the entire ventilation system is of the "forced" variety. Fans, blowers, hoods and ducts of over adequate capacity have been supplied.

The veritable spider web of pipe lines is always an engineering problem of greatest magnitude. Intensive study in the drafting room as well as excellent workmanship and ingenuity in the field is required to keep the pipe line short, but still maintain proper slope for complete drainage. Jet black, dark, red, pale and white products must be completely segregated. Each must have a separate system of tankage, piping and packaging points in order to prevent contamination. Systems of strainers or filters must be supplied at all fill points to assure clean products. High grade motor oils must be kept separate from industrial products.

The new plant can boast of the highest speed oil can filling line in Canada. Eighteen thousand cans per hour can be filled and sealed with accuracy and precision. A new system, called bulk handling, will be utilized. Cans arrive at the plant in box cars, piled loosely in tiers, open end out. A connecting conveyor is run into the car and the cans picked up approximately 20 at a time by means of a multi-pronged fork which is reminiscent of a pitchfork. Cans are placed on the conveyor and can be routed at will, directly to the canning machine or to storage bins from whence they can later be re-routed to the canning machine.

Just before cans go to the filler, they are automatically turned upside-down and high pressure air is jetted into the can from below, insuring that no dust, dirt or packing straw remains in the can to contaminate the oil. After filling and sealing, the cans go in procession to the automatic caser and gluer. The cases are then automatically rotated 90° in order to receive on one end the automatic stencil which identifies the grade of oil, the source and the serial number of the case.

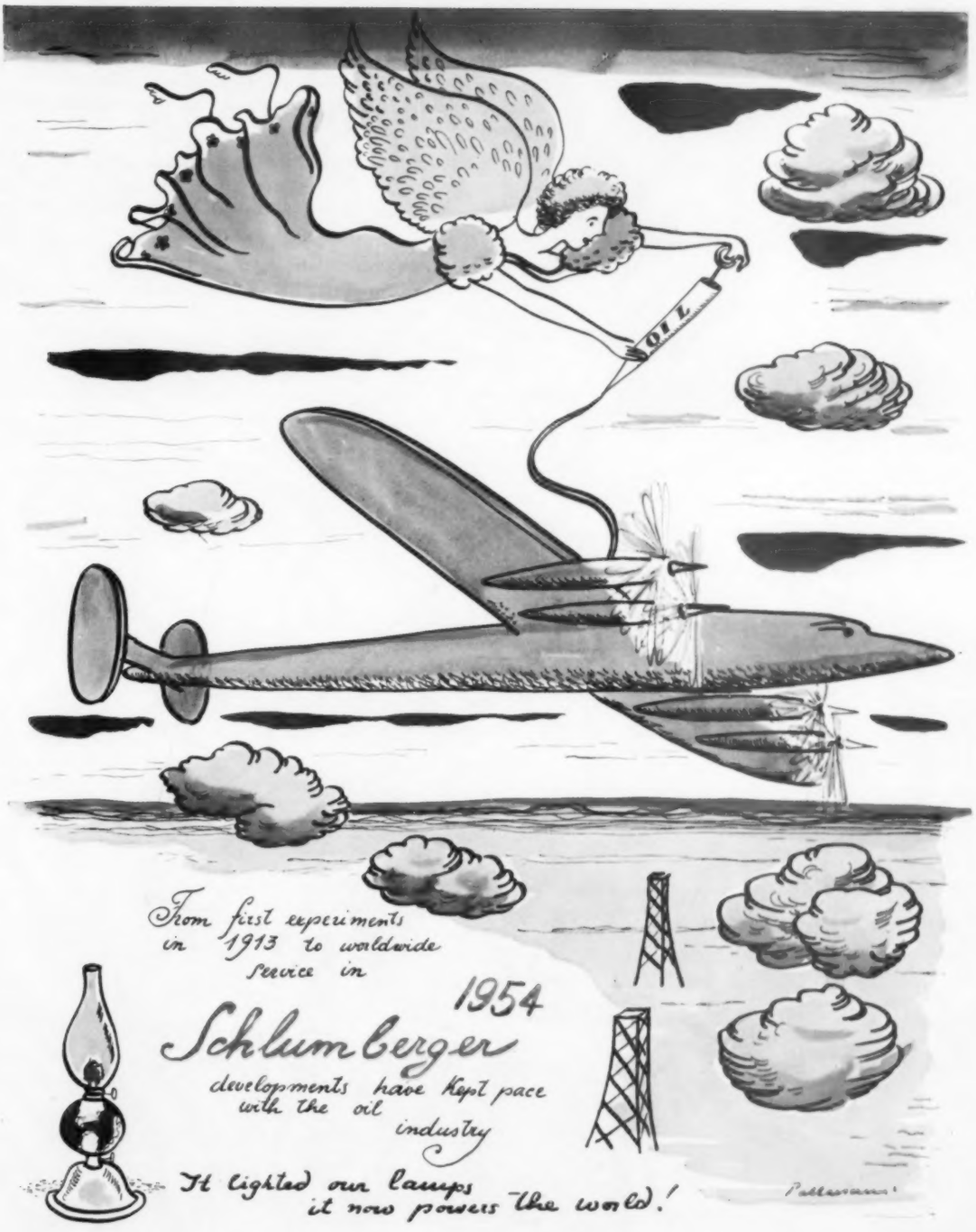
Blends or compounds of petroleum oils with other ingredients must be prepared in mixing devices. Some of these compounds are fast-moving products, but many are small volume specialties. Certain compounds can be prepared by very simple blending operations, others require more vigorous mixing methods. The new plant is equipped with many types and sizes of mixing vats, automatic continuous proportioning and homogenizing. Certain ingredients of a compound combine easily by merely blowing with air in a vat or tank. Others respond better to lightening mixers of the high speed propeller type. Still others require paddle type mixers which are steam-heated vats equipped with wide sweep, slow-moving paddles. Heavy duty and other motor oils are prepared in the plant automatically and continuously in Canada's first proportioner-homogenizer unit. Here, up to six ingredients can be automatically and precisely measured and proportioned to the homogenizer, where the components impinge on the center of a spinning disk. The ingredients travel rapidly in a thin film to the outer edge of the disk, where the travel at high speed is interrupted with violent hammer-like abruptness. This action literally pounds the ingredients together to produce a fixed mixture in which all ingredients are completely dispersed or homogenized.

The plant can receive supplies of compounding materials as well as ship finished products by tanker, tank car, tank truck, transport and box cars.

After the plant has been thoroughly broken in and is functioning smoothly, the company's new line of multi-purpose greases will be manufactured.

Over 3,000,000 gallons of field base stock bulk storage, over 140,000 gallons of inside bulk product storage, and a very considerable amount of packaged product storage space has been provided. However, the plant is designed more to handle orders quickly, rather than to depend on huge inventories of finished products.

The opening of the new plant will be a happy occasion and the day when the company can resume normal product movement is anxiously awaited.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Evolution of a Refinery

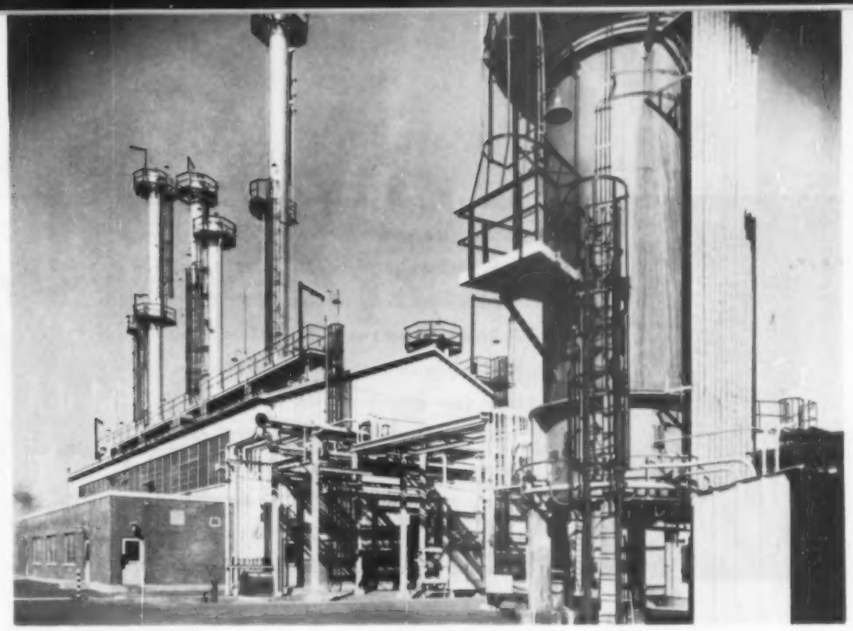
(Continued from page 123)

from the bottom of the fractionator through a steam generator and thence back into the top of the desuperheating trays. With the new slurry-to-feed exchangers installed ahead of the steam generator, approximately 15 MM Btu/hr of this heat is diverted to the catalytic cracker feed, raising the temperature of the latter by approximately 100° F. This makes it possible to run at higher catalytic cracking unit feed rates without increasing catalyst circulation rate or sacrificing reactor temperature and conversion. Other revisions of the catalytic cracking unit included installation of additional cyclone capacity in both the reactor and regenerator, additional condensers and heat exchangers, and revisions of blower discharge piping and air distributor to reduce pressure drop in the air system. The disc-and-donut trays in the fractionator desuperheating section, which had been found to be limiting and creating flooding conditions in the bottom of the column, were removed and replaced with turbo grids. The latter have resulted in considerably increased capacity and improved vapor/liquid heat exchange.

At the vacuum flashing unit, the major bottlenecks consisted of preheat and overhead condensing capacity. Prior to revisions, the topped crude from topping unit No. 1 was used as an internal heat medium in that unit. Flow arrangement was revised to permit the straight run residue to run directly to the vacuum flasher. Circulating hot oil from an existing heat medium furnace was substituted as heat medium in the topping plant. Subsequently, a small idle furnace was retubed and reactivated to further preheat the straight run residue to the vacuum flashing unit. As a result, the temperature of straight run residue which previously ran 100° F below crude column temperature is now 100° F above this temperature as it enters the "flasher."

The overhead condensing capacity was increased by adding duplicate exchanger units to the vacuum flasher overhead exchanger system. This had a double-barrelled effect in that the additional cooling was taken in the highly desirable form of crude oil exchange, thereby providing needed preheat for the topping unit. (Photo 6).

While the foregoing process changes were being effected, important developments were taking place also in the field of transportation of crude and products. Montreal is situated on an inland waterway—the St. Lawrence River—which is non-navigable during the winter months, approximately December-April. Originally, therefore, the refinery was equipped with sufficient tankage to permit building crude stocks during the summer months.



7. IPA/Acetone petrochemical plant commissioned in 1953.

Delivery was by ocean tanker from either the Gulf or Venezuela. Moreover, product storage capacity had to be provided both at the refinery and in company terminals through the marketing area to cover the virtual cessation of shipments during the winter.

Exigencies of the second world war placed a very high premium on tanker time and spurred the installation of a crude pipe line from Portland, Maine to Montreal East. A 12-inch line was installed in 1942 by Portland and Montreal Pipe Line Companies. This line reduced tanker round trip time by 2,000 miles by eliminating the haul up and down the St. Lawrence River. A second 18-inch line was installed in 1950 to bring capacity into line with requirements of the four major refineries in Montreal East. Crude is now available year-'round, and new refinery tankage requirements have consequently been considerably reduced.

In 1952 a new products pipe line was installed to carry refined products from Montreal to Toronto and Hamilton and intermediate points. The line, which is owned and operated by Trans-Northern Pipe Line Co., has a capacity of 60,000 b/d and has eliminated much of the slow and costly up-river marine shipments. Moreover, year 'round continuous supply is now possible and great savings in product storage requirements both at the refinery and at the terminals have been effected.

Early in 1952, Shell made its entry into the Canadian petrochemical field with the commissioning at the Montreal East refinery of its new plant for the manufacture of isopropyl alcohol and acetone. (Photo 7). The raw material charge (propane/propylene), emanating from the light ends recovery section of the catalytic cracking unit, is contacted with sulfuric acid to form the esters which are then hydrolysed to isopropyl alcohol. The latter is converted to acetone by catalytic dehydrogenation. Capacity of the plant is 20 million pounds of product per year.

One of the most significant features of the refinery's growth over the years has been the full utilization of the older facilities. The original combination Dubbs unit built in 1933 still processes about one-third of the total crude run, while the cracking section performs the important function of vis-breaking pitch from the vacuum flashing unit. The fact that the remaining two-thirds of the refinery crude intake is processed largely in revamped alkylation plant equipment, the remainder of which is chiefly used for treating gasoline components, illustrates the versatility of refinery facilities.

Naturally, in each instance the decision to expand or convert existing units is made only after careful study and weighing of the economic factors involved. Performance of a revamped unit relative to a new plant is always weighed against the capital savings involved, which are often considerable. Furthermore, careful consideration has to be given in cases where equipment has reached the stage where cost of maintenance becomes excessive or where safety of operation may be impaired. Nevertheless, after application of these principles at Montreal, considerable success has been achieved in prolonging the useful life of plant equipment and in establishing thereby sizeable increases in processing capacity.

From what has been said, it will be evident that the progressive expansion of the refinery to meet an ever-increasing demand for products has been carried out to a large extent by bottleneck removal. The success of such a program has been made possible through the application of technical advancements in the field of petroleum refining and the ingenuity of operating, engineering and technological personnel in the refinery. The study of bottleneck removal is continuing intensively and plans are already underway to make possible still further substantial increases to the capacity of existing units.

Gordon R. Ball, president of the Bank of Montreal, entered the banking business in 1914. He was in military service from 1915 to 1919 and was awarded the Military Medal while with the Canadian Expeditionary Forces. In 1924 he was sent to New York where he served the bank for 20-odd years in various capacities from manager of the securities department to first agent. He became general manager at Montreal in 1947 and has been president since 1952. He serves as a director of a number of important Canadian companies, including International Nickel and Sun Life.

Canadian capital expenditures $30 billion in seven years

By Gordon R. Ball

President, The Bank of Montreal

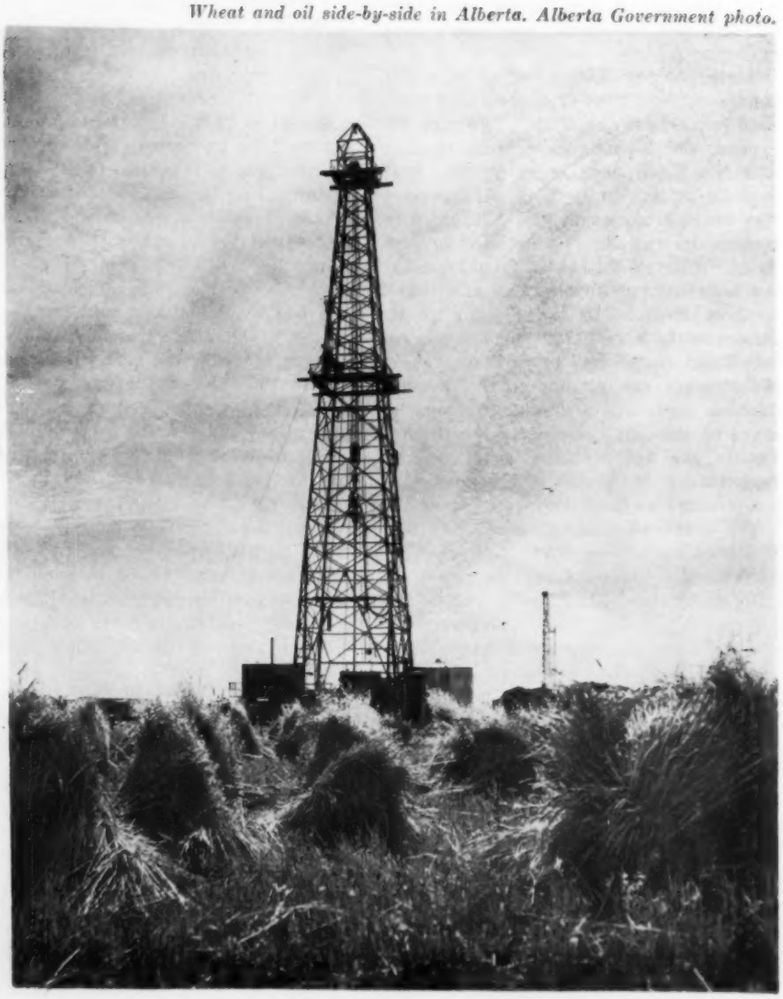
WHAT HAS CAUSED Canada's total national output of goods and services to increase in physical volume by a third between 1946 and 1953? There have been many factors. There were the pent-up demands for consumer goods that had been deferred, not only during World War II, but also to some extent during the depression years. There was an unforeseen growth in population. There were broadening export markets, particularly in the United States. There were expanding social security payments by government, together with the rearmament program suddenly imposed by the onset of the Korean war.

But fully as dynamic as any of these has been the vast enlargement of the country's physical assets in response to discovery and development of natural resources and to general growth. Projects in this capital expenditure program run the gamut of mobile construction and exploration equipment; fixed plant and machinery for manufacturing, processing, transporting and storing goods, and for providing utility services, municipal services and public works; they include office buildings, hotels, stores, hospitals, schools and, not least, apartments and houses.

When all these forms of new capital expenditure are put together, their total value in the eight years 1946 through 1953 amounts to $30 billion. In every year since 1946 the annual total has been

(Continued on page 140)

Wheat and oil side-by-side in Alberta. Alberta Government photo.



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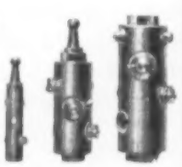

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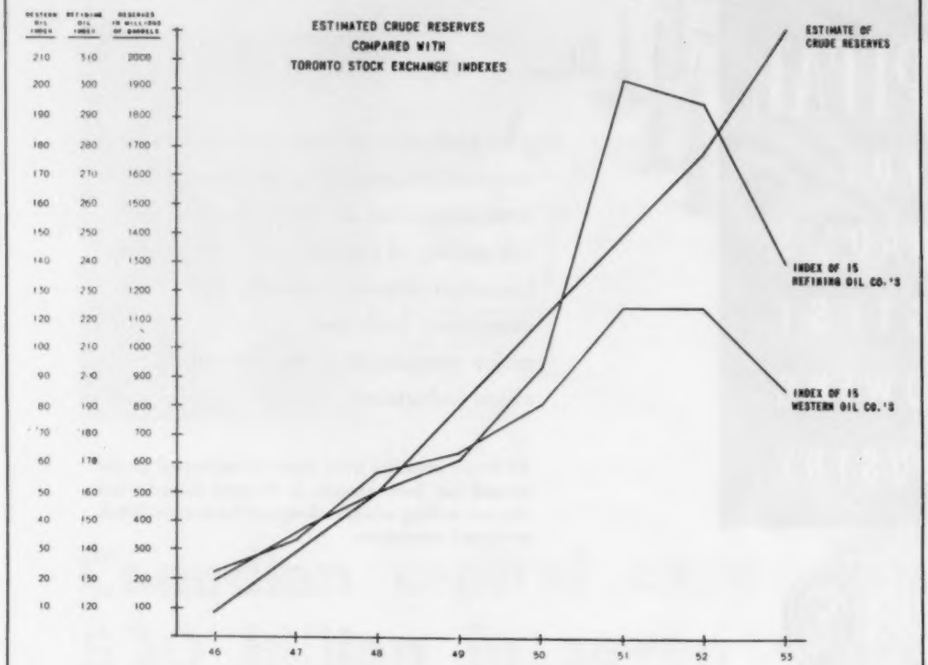

Chart showing growth of crude reserves in Canada compared with Toronto Stock Exchange indexes of the value of Canadian oil stocks. Chart courtesy Imperial Oil Ltd.

Canadian Capital Expenditures

(Continued from page 138)

greater than the year before. And just recently, C. D. Howe, Minister of Trade and Commerce, announced the results of a very thorough survey which shows that Canadian business enterprises and individuals are, once again, planning larger expenditures of a capital nature this year than they made last year. What is even more significant, the additions to physical capital have represented nearly 21 percent of Canada's total national production in the post war period as a whole, and an even higher percentage in recent years. In other words, we in this country have been plowing back into durable physical assets, rather than consuming immediately, between a fifth and a quarter of our national output—a higher proportion than in the United States and much higher than in most other countries.

In no direction has this provision for the future been more notable than in the exploration and development of oil and gas fields and the building of pipe lines, refineries and by-product industries. It is a rule of thumb, I understand, that to bring one barrel of oil per day from the well to the consumer requires a capital investment of $5,000. A large part of the oil industry's expansion has been financed by investment capital from the United States or elsewhere. But the oil industry is not a typical example of the incidence of foreign investment and it should not be inferred that Canada's expansion as a whole has been financed mainly by external capital.

(Continued on page 142)

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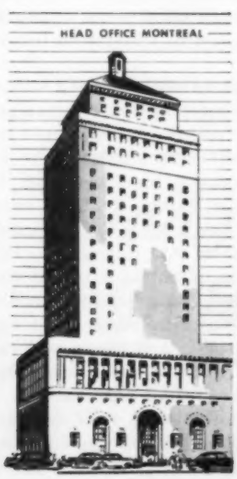

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Canadian Capital Expenditures

(Continued from page 140)

It is true that this country's growth has proved attractive to outside investors. The foreign stake in Canada has increased in seven years by a little over $3 billion, from $7 billion at the end of 1945 to over $10 billion at latest report at the end of 1952. These figures represent the outstanding book value of both direct investment by foreign companies in Canada and foreign holdings of Canadian securities, and they reflect both the movement of new capital funds and the reinvestment of earnings.

When we compare this increase of $3 billion in foreign investment in Canada during seven postwar years with the figure of $30 billion of new Canadian capital expenditures as a whole in eight years, it becomes clear that a little under eight percent of Canada's total postwar spending of a capital nature has been financed by outside investors. And I might add that the 92 percent underwritten by Canadian capital is a higher proportion than prevailed in earlier periods of rapid development.

Nearly all the $3 billion increase of foreign investment in Canada represented United States capital, and close to 25 percent of it went into the oil and gas industries in one way or another.

The exceptional degree of foreign participation in this one industry raises the question of the extent to which it is actually controlled outside the country. The Canadian Government has made a special study of this question which showed that, of the total book value of investment in the Canadian petroleum industry, the proportion controlled in the United States, by virtue of majority U.S. ownership of voting stock, had risen from 58 percent at the end of 1945 to 62 percent at the end of 1951. In those companies engaged mainly in refining, transporting and selling petroleum products, U. S. control has always been high and has changed little—from 68.5 percent in 1945 to 69.5 percent in 1951. In companies mainly devoted to exploration and development, on the other hand, U. S. control was less than 14 percent at the end of the war, but exceeded 46 percent by the end of 1951 and is by now probably well over the 50 percent mark.

Helicopters are used to supply and set up geological camps in remote parts of northern Alberta, British Columbia and the North West Territories. Imperial Oil photo.

Misgivings are sometimes expressed about the widening area of American control in the Canadian oil industry and the fact that Canadian investors participate mainly by taking the funded debt. This, I should add, is typical not only of the oil industry, but also of certain petrochemical and iron ore enterprises. While I do not contend that it is entirely desirable, I feel it is in many ways a natural development that should be understood before it is criticized.

The oil industry is uniquely a world industry, its international structure and organization having sprung from the fact that oil can, and does, move freely across national boundaries. It is an industry, moreover, that is controlled to a major extent by U. S. and British capital. It was only to be expected, therefore, that much of the stimulus to explore and develop the oil potentialities of the Canadian West in the wake of Leduc should come from U. S. companies, whose need for new reserves is insatiable, and whose exploration programs are massive and backed by ample equipment and trained personnel.

In confirmation of this view, it is interesting to look at the other side of the coin—at

(Continued on page 144)

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Canadian Capital Expenditures

(Continued from page 142)

the character of United States foreign investments everywhere. Here we find that the amount of privately held U. S. investment in controlled enterprises outside the United States has doubled in the past ten years, from a little under $8 billion in 1943 to an estimated $16 billion at the end of 1953. But U. S. direct investment in the petroleum industry elsewhere more than tripled in the decade. Of all U. S. foreign investment today, close to a third is in Canada—four times as much as in the second ranking country. Moreover, it is worth pointing out that a considerable part of the increase in the U. S. investment stake here has come about by the reinvestment of profits. In other words, for this country, U. S. investment has not been a drain, but an accumulating benefit.

All these figures underscore in my mind the advantage of U. S. participation in Canadian oil development. They emphasize, too, the need to guide that development along sound lines, as it has thus far been guided by the conservation policies of the governments concerned, and by the production policies of the companies involved. But the best

(Continued on page 146)

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Canadian Capital Expenditures

(Continued from page 144)

of judgement must continue to be brought to bear in shaping the growth of so youthful and robust an industry. The capital that is made available for the development of oil resources on a worldwide front, and which has been coming to Canada in such generous quantity, does not always have to move in the same direction. There is keen competition for oil development capital, and the recent initial discovery in Australia is a case in point.

Examples of the consequences that can follow from unwillingness to recognize the international nature of the oil business are not far to seek. Since Mexico nationalized its petroleum industry in 1938, new discoveries in that country have been few, and its crude output has fallen from 25 percent of the world total in the early 1920's to two percent today. The case of Iran is still too much with us to require rehearsing.

What of the future? What can be said on the question of the business outlook—the question that is in everyone's mind? One point that can be made is that, in gauging the demand for its products in the immediate future, the petroleum industry can be more confident than most. The large number of motor vehicles, oil burners, diesel and other consuming units that have been coming into operation is a solid basis on which to predict further gains in the consumption of petroleum products.

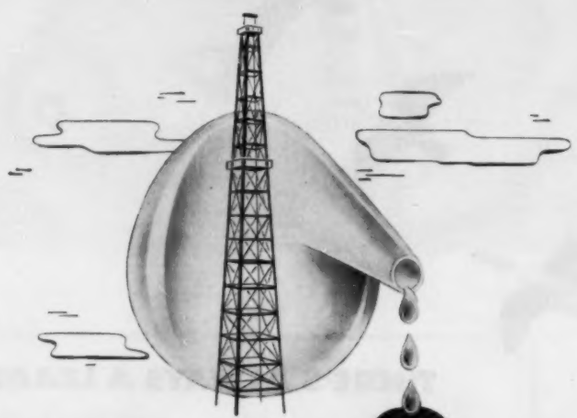
In the economy as a whole, however, the wind seems to be changing and the period ahead promises to be a testing time. After the long stretch of good years that I have already described, a fairly widespread adjustment appears to be under way. It is evident in a leveling out or decline in such general indicators as industrial production, employment, income, retail sales, exports and government expenditures. The same sort of thing has been happening in the United States. As to how long the adjustment will persist and how far it will go, it is yet too soon to say. Such adjustments can be corrective in nature, or they can become cumulative.

Of one thing we may be quite sure. There will be greater competition and it will bite more deeply. It will be felt in export markets and it will be felt at home, not only among domestic products, but between domestic and imported products. Such conditions emphasize the importance of improving efficiency and cutting unit costs by every technique that can be devised, short of reducing wages. Canadian income levels are the second highest in the world and we want to keep them high. Labor costs can be a factor in pricing a product out of the market, but they do not have to be, if wage cost per unit of output can be reduced. In the efforts that must be made toward this end, the capital expenditures of recent years, which have brought more and more outside energy to the hand of the worker in the factory and on the farm, will stand us in good stead. To the growing use of energy sources, the oil and gas industries have made a notable contribution. On a *per capita* basis, Canadians are the second heaviest users of oil in the world. I know that the petroleum industry is keenly conscious of its role in adding further to Canadian productivity.

If we in Canada will face, rather than fear, competition; if we have confidence that we can meet the tests ahead; if we believe in our long-term future enough to keep betting on it; then I am convinced that the months to come will prove to be but a period of consolidation—a necessary stage in the growth process.

As a nation we have progressed far in the recent past by daring to undertake new and bold ventures that might have seemed beyond our capabilities.

We have gained much experience in the process and we shall gain more, under perhaps less propitious circumstances, in the months ahead. Given the will to try, and the willingness to learn, there will follow a period of expansion that could dwarf anything we have yet known.



Share in Canada's Potential OIL Wealth

This year will add another interesting chapter in Canada's story of oil wealth. This important industry with pipeline facilities extending both eastward and westward from rich prairie oil fields now has a productive capacity of over 300,000 bbls. daily. The fact that Canada's ultimate oil reserves have barely been tapped in the seven years since Leduc gives impetus to the strengthening position of the economy in this country.

Oil, gas and pipeline companies desiring to become established in Western Canada, those planning further plant expansion, or requiring additional working capital are invited to come in and discuss, without cost or obligation, ways and means of obtaining funds for their particular needs.

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International Announces Revised Truck Catalog

A revised 24-page catalog describing the performance features and specifications of the Standard, Loadstar and Roadliner models of International 6-wheel heavy-duty trucks is available from the International Harvester Export Co. Copies of this catalog, E-60D, may be obtained from International motor truck distributors throughout the world, or by writing to the International Harvester Export Co., 180 N. Michigan Ave., Chicago 1, Ill., U.S.A.

GATX Services and Products

A handsome book has been published by General American Transportation Corp., Chicago, to describe its services to the petroleum, chemical and other industries and the products it offers. Primarily the company is a service organization built on its fleet of railroad cars and its storage and packaging terminals.

In recent years the company has expanded its operations to include engineering services and the sale of equipment. Code welded vessels and other plate structures are manufactured. Vapor saving tankage is built, as are process equipment items for the chemical and petroleum industries. Screw fasteners are made in large quantity. GATX serves the plastics industry in the design and molding of products. It offers a chemical process for nickel plating which has special advantages in precise work.

In preparing the book, Robin Douglas, GATX advertising manager, has pointed out how many of the company's operations have developed from the original function of providing transportation service.

Accounting Manual

Publication of a new manual on petroleum industry accounting procedures was announced by the American Petroleum Institute.

Entitled "Outline of Petroleum Industry Accounting," the manual is designed as a reference book for companies having established procedures, and as a guide book to help new employees obtain an over-all perspective of industry practices.

Data for the new manual were compiled by the Accounts and Accounting Procedures Subcommittee of the Institute's Financial and Accounting Committee. Copies may be obtained through the Institute's headquarters at 50 West 50th Street, New York 20, New York at $3.00 each.

To Modernize Baltimore Refinery

A $15 million construction and modernization program at its Baltimore refinery has been begun by Esso Standard Oil Co. New processes to be installed are fluid coking, Hydrofining and Hydroforming.

The fluid coking unit will have a capacity of 10,000 b/d, and the Hydrofining unit a capacity of 17,000 b/d. A 3,000 b/d Hydroforming unit will supply by-product hydrogen for the desulfurization and carbon-residue reduction of naphtha and heating oils.

Contracts for the construction of the Hydrofining and Hydroforming units have been left to Foster Wheeler Corp. Bechtel Corp. will construct the fluid coking unit. A Baltimore firm, Whiting-Turner, will erect the new mechanical shops.

Tulsa Gets Dresser Regional Headquarters

Dresser Industries has purchased a 15-acre tract in Tulsa for the development of regional headquarters for various subsidiaries. First unit to be built will be an office and parts warehouse building for Clark Brothers. Other Dresser units will move to the new site as soon as present lease commitments expire. Several additional buildings will be needed eventually. Some manufacturing operations will be located there. General offices of Dresser Industries will continue to be located in the Atlantic Building, Dallas.

Diesel Specification Folder

An illustrated specification folder on UD-350 Diesel 78.5 B.H.P. engines and 75 B.H.P. power units is available from the International Harvester Export Co., 180 N. Michigan Ave., Chicago 1, Ill., U.S.A.

In addition to engine and power unit specifications, the eight page folder also includes UD-350 performance ratings for units with 1,800 rpm, governed speed, and complete lists of power unit components and attachments. Ask for folder E-68-D.

Joins National Aluminate

Joseph W. Moorman, formerly with The M. W. Kellogg Co. and more recently a consulting engineer, has joined the catalyst division of the National Aluminate Corp. in a technical sales capacity. He will represent Nalco primarily in the Mid-Continent and Gulf Coast areas, and will be available, when needed, to assist in analyzing Nalcat catalyst performance in commercial units.

Geared Turbine Generator Bulletin

Geared turbine generators, 200 kw to 1,500 kw, for both AC and DC service, are the subject of Bulletin 1939 now offered by Worthington Corp., Harrison, N. J. The bulletin describes engineering and construction features of the turbine generators, including two types of governing arrangements, hand and automatic nozzle controls, and other controls and accessories.

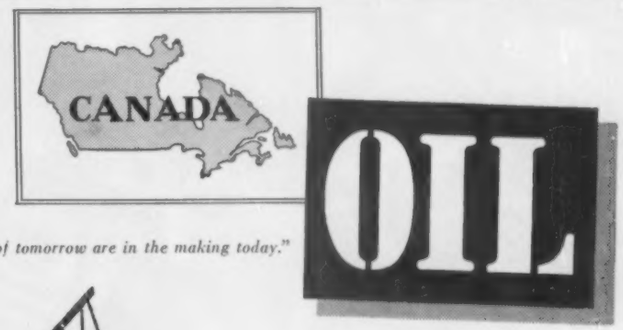
Sun Announces Marcus Hook Promotions

Sun Oil Company has announced a series of promotions and new appointments among the staff of its Marcus Hook refinery.

C. Calvin Naylor was named assistant to Marcus Hook refinery manager W. T. Askew. Mr. Naylor formerly was operating assistant to Fred R. Lang, assistant superintendent in charge of catalytic cracking.

Walter C. Huffman became assistant superintendent in charge of petrochemicals. He formerly was general foreman of petrochemical Plant 17.

Named to the post of operating assistant in the catalytic, gas and alkylation division is William J. Devonshire, Jr., formerly general foreman at Plant 16. Succeeding Mr. Huffman as general foreman at Sun's new petrochemical Plant 17 is Calvin Stubbs, formerly supervisory foreman there.



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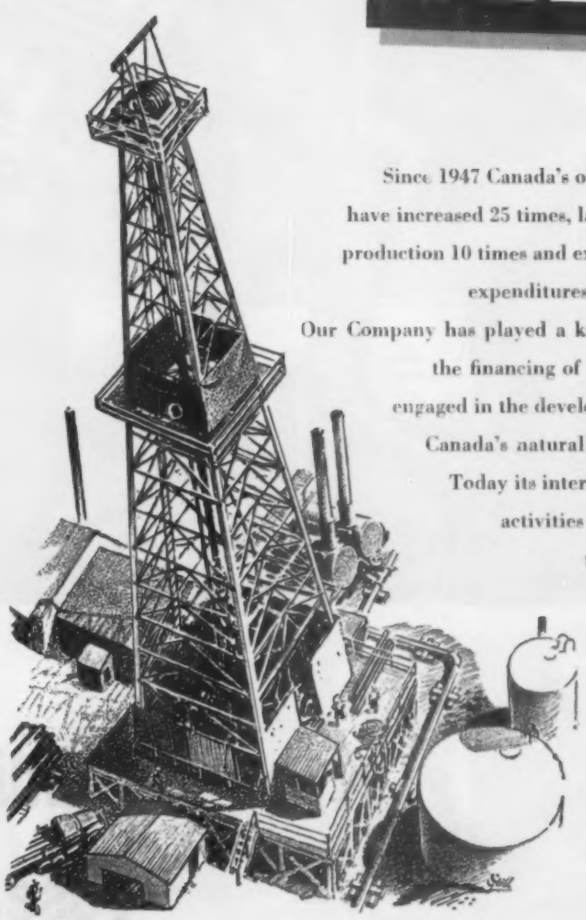

Since 1947 Canada's oil reserves have increased 25 times, land under production 10 times and exploration expenditures 25 times. Our Company has played a key role in the financing of industries engaged in the development of Canada's natural resources. Today its interest in such activities is greater than ever!

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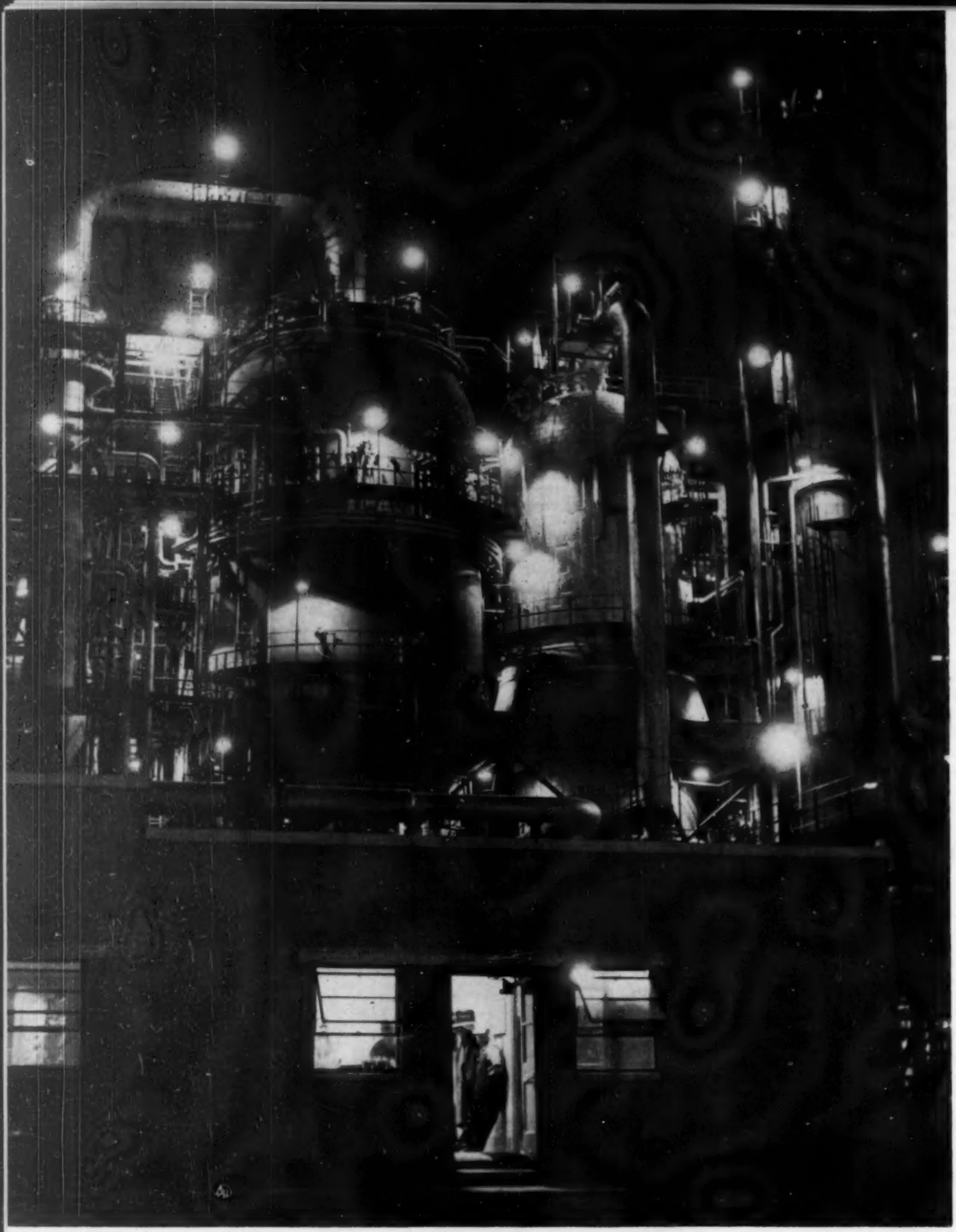


Imperial Oil Ltd. completed expansion of its Sarnia, Ont., refinery to 71,000 b/d capacity in 1953, making it the largest in Canada. Type IV cat cracker is shown.

Canadian refinery capacity rose 11 percent in 1953

CAPACITY OF OIL refineries in Canada increased 50,000 barrels or 11 percent in 1953 to 509,100 b/d at the close of the year. Another 47,000 barrels of new capacity will go on stream this year. In 1952 37,000 barrels of new capacity was activated, an increase of nine percent. Canadian refineries now have more than double the capacity available at the end of World War II.

The rapid expansion of processing facilities has not been great enough to overtake domestic demand for petroleum products. In 1953 domestic demand rose 57,000 b/d, while refinery capacity was increasing 50,000 b/d. Capacity probably will fall a bit further behind this year. The following table gives an indication of how capacity has trailed demand during the past five years:

THOUSANDS OF BARRELS DAILY

Year	Domestic Demand	Refinery Capacity Jan. 1	Capacity Added in Year	Demand Increase In Year
1949	313.5	315.5	18.1	23.6
1950	357.9	336.6	25.3	44.4
1951	410.7	358.9	62.7	42.8
1952	460.0	421.6	36.8	49.3
1953	517.0	458.4	50.7	57.0

Crude runs to stills can never be maintained at 100 percent of rated capacity in any large group of refineries over an extended period. The deficiency in Canadian capacity when compared with domestic consumption is thus greater than is indicated by the tabulation above. In 1953, runs were about 88 percent of capacity, with the result that Canada was forced to import about 28 million barrels of refined products to supply its needs.

Following is a tabulation of refinery crude runs, domestic demand and refined oil imports in recent years.

THOUSANDS OF BARRELS DAILY

Year	Crude Runs	Domestic Demand	Refined Oil Imports
1949	261	314	36
1950	298	358	63
1951	357	411	67
1952	380	460	74
1953	428	517	77

Capital requirements of the refining branch of the industry for expansion have been great since the war and obviously will not decrease in the immediate future. About $50 million per year has been needed for plant expansion and modernization since the war. It is anticipated that similar runs will be needed each year for an indefinite future period.

A number of large projects are under construction now and are scheduled for completion this year. Still others are in the design stage and will not be in operation until 1955. In this latter category are the Imperial Oil Ltd. $25 to $30 million rebuilding job at Halifax, $10 million expansion at Montreal and $15 million lube plant at Edmonton; Canadian Petrofina's new 20,000 b/d plant at Montreal; and the North Star Oil Ltd. 12,000 b/d plant at Winnipeg.

The year 1954 already has seen the completion of a number of significant refinery jobs and others are to follow rapidly during the remainder of the year. Elsewhere in this issue is a detailed report on the new Sun Oil Ltd. refinery at Sarnia, Ont., which recently added 15,000 barrels of crude capacity to the Dominion's facilities. The plant is designed for maximum production of high octane motor fuel with catalytic cracking and a catalytic reformer for upgrading straight run naphthas. It is the second plant in Canada to be equipped with a platinum type catalyst reformer.

In this immediate area Imperial completed its major job at Sarnia in 1954 in time to receive Prairie crude through the new Lakehead extension of the Interprovincial pipe line system. Plant capacity was increased 14,500 b/d in 1953 to 71,500 b/d at the beginning of this year.

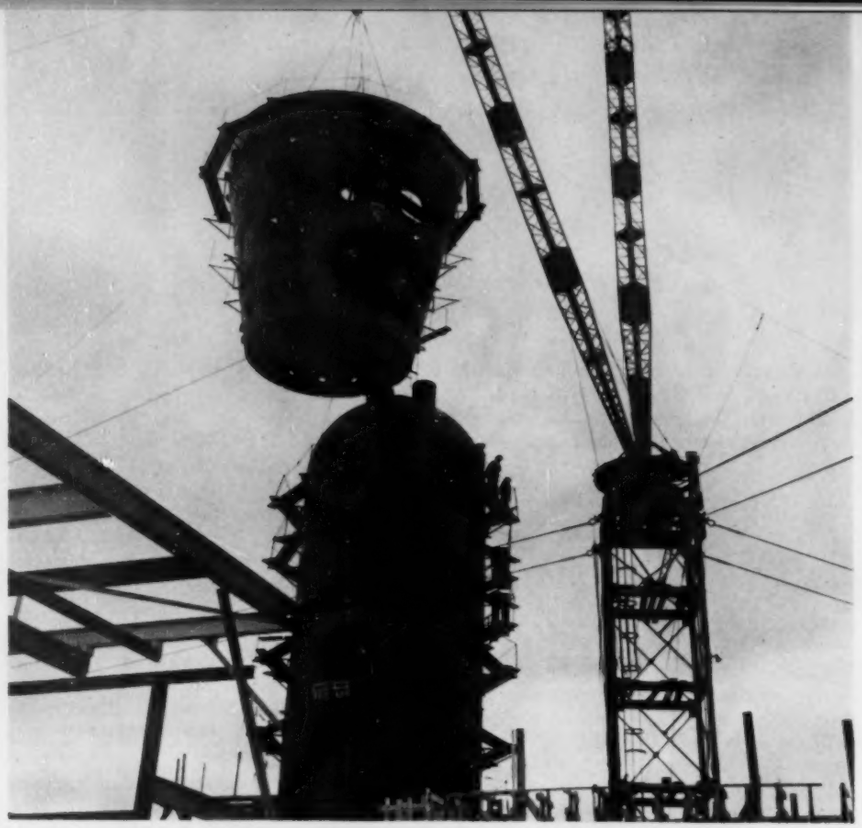
At Clarkson, construction of catalytic cracking gas recovery and catalytic polymerization facilities has passed the 50 percent completed mark at the Ontario refinery of British American Oil Co. Ltd.

Featured in B-A's latest expansion project is Canada's first Model B Orthoflow fluid catalytic cracking unit, engineered and constructed by The Canadian Kellogg Co. Ltd. Design capacity of the cat is 11,610 b/sd of fresh feed, while the gas recovery and cat poly units are sized to handle extraneous systems derived from existing topping and thermal cracking operations in addition to the gas made from the FCC Unit.

An innovation, as far as British American is concerned, will be the use of electric motor drives on the air blower and the gas compressor. The air blower motor, rated at 4,500 hp, is one of the largest

Expansion has been completed at Shell Oil Company's Vancouver, B. C., refinery which now has a capacity of 15,000 b/d. Polymerization plant and the depropanizer and stabilizer columns are in the foreground. Partially hidden is the new fluid catalytic cracking unit. Included in the expansion program are a vacuum flasher, various buildings and increased storage.

Imperial Oil's Ioco refinery was opened on September 16, 1953 after an 18-month reconstruction program which raised the plant's capacity to 22,500 barrels a day. New installations included atmospheric and vacuum distillation units and the first fluid catalytic unit in British Columbia. This view is looking northwest across the refinery.



The reactor and transition piece going on during construction of the catalytic cracking unit of British American Oil's Clarkson, Ont., refinery.

induction motors ever built in Canada.

In addition to the new process units, expansion of offsite facilities is proceeding simultaneously. This work will include additions to the stores and shops building, boiler feedwater treating equipment, and expanded facilities for water pumping, compressed air, electrical and steam distribution.

Operation of the new plant is scheduled to begin in June of this year.

At Port Credit, Ont., Trinidad Leaseholds (Canada) Ltd. is building a Platforming unit which will operate at 1,500 b/d. It is designed for economical expansion to 2,500 b/d. The company is planning the erection of additional crude still capacity and a cat cracking plant may be built in the future.

Erection of new capacity in the Toronto area has been retarded by the lack of crude pipe line facilities for year-around delivery of raw materials. At present, refineries here must build crude tankage for about 180 days of operations, thus adding materially to plant investment. Extension of the Interprovincial line would eliminate this difficulty. To avoid the winter tie-up on the lakes, major Canadian companies have built products lines east from Sarnia and west from Montreal to serve the populous Toronto district.

A year ago it was thought that there was enough—perhaps too much—refinery capacity in the Montreal area. Rapid growth of industrial activity there has changed the situation again, however. Imperial now is spending $10 million for a 25 percent expansion at Montreal East. Capacity will rise 12,000 b/d to 58,000 b/d, making it the second largest refinery in the Dominion.

New equipment to be installed by Canadian Bechtel Ltd. includes an atmospheric and vacuum crude distillation unit and a vacuum pipe still. The refinery's cat cracker and several other units also are being enlarged. At present crude capacity is 46,000 b/d, thermal cracking capacity 14,300 b/d, and cat cracking capacity 15,500 b/d.

Elsewhere in this issue is a detailed account of how Shell Oil Co. of Canada has enlarged its Montreal plant over a period of years. In 1953, as a result of an expansion of topping plant capacity as well as minor modifications and improvements on the catalytic cracker, overall capacity of the refinery has been raised to 44,000 b/d for 1954, compared with 38,000 b/d during 1953.

Major changes in the topping plant involved the building of a new primary reboil furnace, revisions of the existing furnace, replacement of trays in the primary column and additional pumping and heat exchange equipment. Performance since the start-up has exceeded expectations.

McColl Frontenac Oil Co. Ltd. installed a new crude fractionator at its Montreal plant in 1953 and built 300,000 barrels of new storage.

Largest current project in the Montreal area is the entirely new 20,000 b/d refinery to be erected by Canadian Petrofina, organized as a $25 million subsidiary of the Belgian Petrofina Co., Cia Financiere Belge des Petroles, S.A. The new Montreal plant will include a Houdriflow cat cracker.

The largest refinery construction project ever undertaken in Canada and one of the largest single construction projects in the history of the Maritimes has been undertaken at Imperial's refinery at Imperoyal, near Halifax. In a building program estimated to cost between $25 and $30 million, Imperial will replace most of its existing plant with a brand-new refinery of almost double the capacity.

Daily capacity of the new plant will be 41,625 barrels, surpassing all except the plants at Sarnia and Montreal. Present capacity at Imperoyal is 22,000 b/d.

Construction will start early in 1955 with completion in the summer of 1956. The existing plant will continue in operation during the construction period.

The new refinery will be built on the present site at Imperoyal, across the harbor from Halifax and three miles south of Dartmouth. It will serve the Maritime provinces and Newfoundland, including Labrador, with products made from crude oil brought by tanker from Venezuela.

The fluid cat to be erected will have a capacity of 27,000 b/d. Other refining equipment to be installed at Imperoyal includes an atmospheric and vacuum distillation unit, a catalytic polymerization unit, a gas recovery plant, a treating plant and a naphtha specialty plant. Additional construction will include mechanical shops for the greatly enlarged plant, a laboratory and technical building, loading racks from which products will be shipped and facilities for providing the refinery with water, steam and electricity. The Imperoyal refinery at Halifax has had a key role in two world wars, and shares a tradition which goes much farther back and even includes (some say) a ghost.

During World War I it became evident that a refinery was necessary in the Halifax area to take care of Atlantic shipping, for Halifax was the key port on the supply line to Europe. In 1916 construction started. Some 1,500 men went to work and about 300 of them lived in camps erected by the company. These camps were torn down in 1921, but not before they had served the citizens of Halifax in time of disaster.

On December 6, 1917, when the Halifax explosion killed 1,600 and injured thousands more, the camps were thrown open to the injured and homeless, who were fed and cared for. Refinery and construction employees took an active part in relief work in Halifax and Dartmouth.

The refinery went "on stream" in 1918 with a daily capacity of 2,200 barrels. Though built to fill a wartime need, Imperoyal had no difficulty in fitting into the economic life of the Maritimes. Early shipments of refined products were made in barrels and tank cars to local dealers. Shipments were also made to the West Indies and Newfoundland.

Between wars the plant's capacity was

(Continued on page 152)

War on the Locusts

A SINGLE SWARM of locusts may weigh 20,000 tons and eat its own weight in green food every day.

To combat this menace Anglo-Iranian scientists have produced specially prepared oil extracts which help to kill locusts by the million. But the surest control of locusts lies in the cultivation of their breeding grounds. This means mechanised farming equipment—and oil-power in plenty.

Anglo-Iranian is getting the oil. By 1955 refinery throughput will approach 600,000 barrels per day. This oil is shipped to the far corners of the world in one of the world's largest privately owned tanker fleets.

From Iceland to New Zealand Anglo-Iranian products are speeding the pace of progress.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

Anglo-Iranian Oil Company

LIMITED

Canadian Refinery Capacity

(Continued from page 150)

steadily increased. It was during this period that the ghost entered Imperoyal's story. In 1927, Imperial added to its refinery property the adjacent 34-acre site of old Fort Clarence.

Fort Clarence was a vast, rambling old-fashioned fortress. It was first built in 1751 as the "Eastern Battery" and its guns covered the harbor as far as George's Island. It was later expanded, and in 1869 became Fort Clarence. It had many winding, narrow flagstone passages. It was along these chill and gloomy corridors that the ghost of a woman was said to wander. The finding of a woman's skeleton in 1917 added a fillip to this story. However, in 1889 a full dozen adult skulls were found, but no mention was made of this potential platoon of ghosts.

After 20 years of peace and growth, in 1939 Imperoyal once more assumed an important role in the defense of the free world.

To speed the flow of oil to Britain's war machine at a time when the United States was still neutral, American tankers hauled oil from the Caribbean area to Imperoyal. Here it was picked up by British and Allied ships and ferried overseas. A top secret during the war years, the system was officially known as Petroleum Foreign Trans-shipments, but more familiarly and realistically to those concerned as "The Shuttle."

Oil was brought to the Imperoyal wharf and stored in five 80,000-barrel tanks which were rented to the British Petroleum Board. At first the Americans kept the tanks full, and Allied tankers were hard put to get the oil away fast enough.

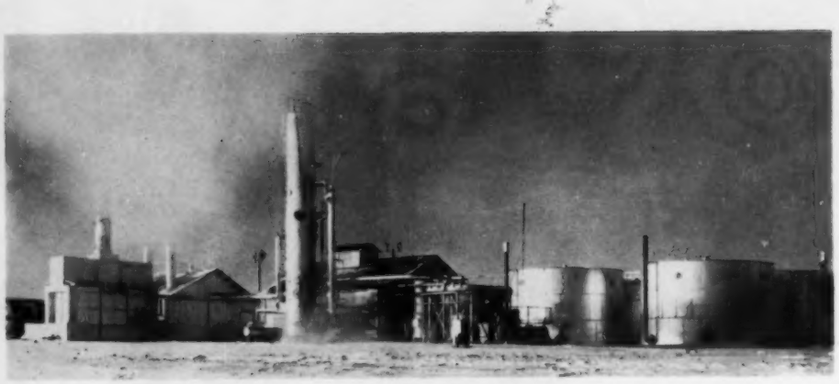
Then the U. S. entered the war. Submarines sank ship after ship on the Atlantic seaboard.

Demands upon the Imperoyal refinery skyrocketed as American ships were added to those clamoring for dock space and fuel. The British Petroleum Board decided to build seven 100,000-barrel steel tanks, together with dock space, pumphouses, lines and all equipment necessary to operate The Shuttle without interfering with the wartime work of the refinery.

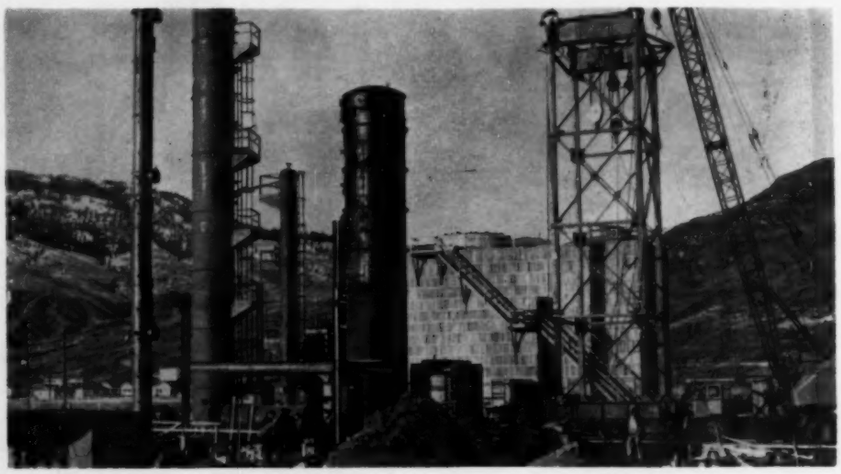
The Fort Clarence property made an ideal site for the new tanks. The nine-inch guns that for more than a century had guarded the eastern entrance to Halifax harbor were hauled away, and Fort Clarence was demolished. The great moat was filled in. The high outer walls and the "solid masonry and bomb-proof casements" were demolished. Some of this granite, quaried in Scotland, can still be seen in use about the refinery. In record time four great steel oil storage tanks stood where once Royal Artillery gunners had strutted in cocked hats, long frocked coats and spatterdashes. No protest was heard from the now homeless ghost.

Still, three other storage tanks were

(Continued on page 155)

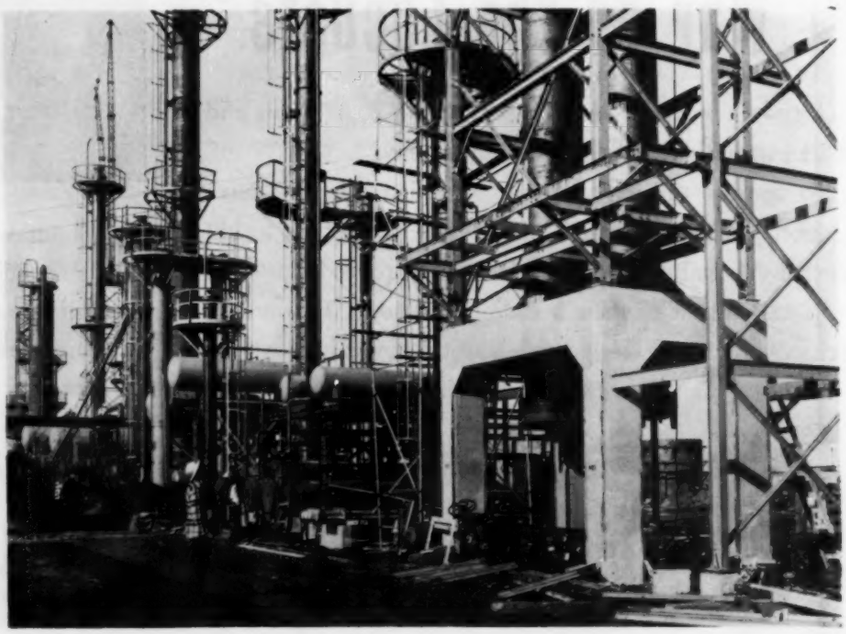


At Coleville, Sask., Royalite owns and operates a 5,000 b/d topping plant which turns out Bunker "C" fuel for use in oil burner locomotives in the Prairie provinces. Other products processed are road oils, asphalt, distillates and gasoline.



Crude oil distillation towers during construction of the 5,000 b/d Kamloops, B. C., refinery of Royalite Products Ltd., subsidiary of Royalite Oil Co. Ltd. Facilities will include a 1,450 b/d UOP fluid catalytic cracker and a UOP 100 b/d poly unit, a 2,000-pound vacuum distillation unit, and a gas concentration unit.

A portion of the polymerization, gas concentration, and catalytic cracking units at the Regina, Sask., refinery of Consumers' Co-operative Refineries Ltd.



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(Continued on page 155)

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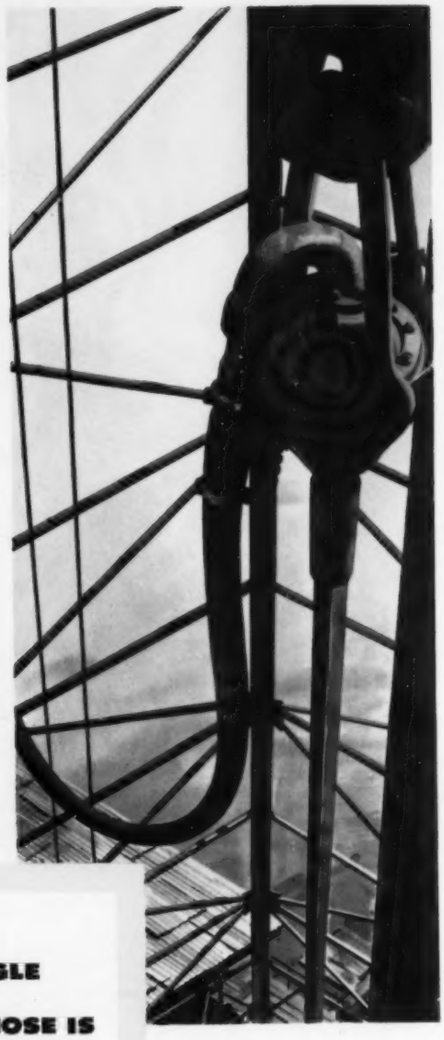

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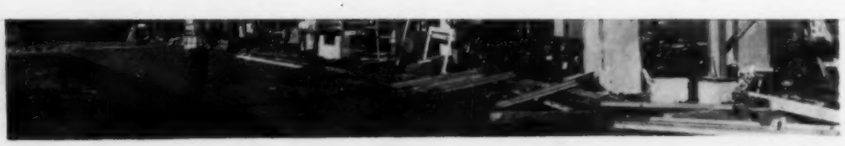


Canadian Refinery Capacity

(Continued from page 152)

needed, but ship-building took priority in steel. It was decided to build concrete tanks—a difficult and costly job. These were completed before Operation Shuttle ended with the war in Europe.

Imperoyal refinery handled more than 33 million barrels of oil in The Shuttle and at the same time fuelled 10,600 Allied ships with 25 million barrels of oil during the years 1940-45.

After the war, Imperoyal returned to its peacetime job of supplying the Maritimes, Newfoundland and Labrador with petroleum products. Tankers bring crude oil from Venezuela, and approximately half the peacetime shipping tonnage entering Halifax harbor is in connection with the refinery operation.

Prior to the discovery of the Leduc field, the refining industry in the Prairie provinces was not of great importance. It consisted of a large number of small plants designed to serve local communities. In 1939 there were 27 refineries in the three provinces of Manitoba, Saskatchewan and Alberta, with a combined capacity of 35,420 b/d. Average per plant was only 1,300 b/d. At the close of the war, the industry still had a rated capacity of only 40,000 b/d and the number of plants had shrunk to 14.

As discovery followed discovery after Leduc, oil companies began a building program which dwarfed that in other parts of the Dominion. By the end of 1953, Prairie capacity had risen to 142,000 b/d at 24 plants. Average capacity per plant was five times as great as prewar.

Despite the active building of the past five years, there is still much activity at refineries in the Prairie provinces. Last year McColl-Frontenac made certain alterations in its fluid cat cracker at Edmonton which resulted in an increase in crude capacity from 5,500 to 7,000 b/d. Work is now in progress on a $4 million project which will make a further increase to 11,000 b/d. A 3,000 b/d thermal cracking unit is to be added.

Also at Edmonton, Imperial is spending $15 million in the erection of the first large scale lube plant to be built in the west. The plant will reduce the cost of Imperial's marketing operations in the west by eliminating the long rail haul now necessary. All except a few specialty oils will be manufactured at Edmonton.

The new lubricating oils plant will be second in size and capacity only to Imperial's Sarnia equipment, which is the largest in Canada. It will produce about 750,000 barrels of high quality automotive and industrial oils a year.

In addition to new equipment, some of the refinery's existing units will be adapted to provide the raw material for the new plant.

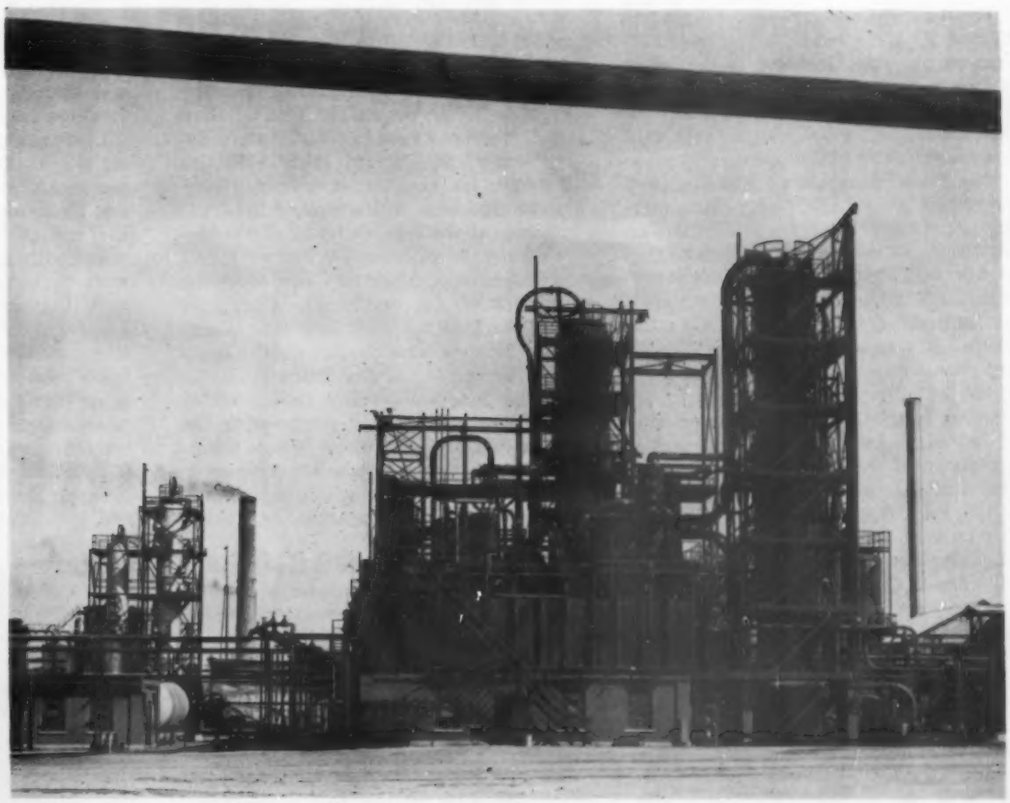
Construction is planned to commence this year, with completion late in 1955.

The lube plant will be of unusual interest to the refining industry since it will hydrogenate raw lube stocks to improve the quality of finished oils. It is understood that a reforming unit is to be built to upgrade naphthas and provide hydrogen.

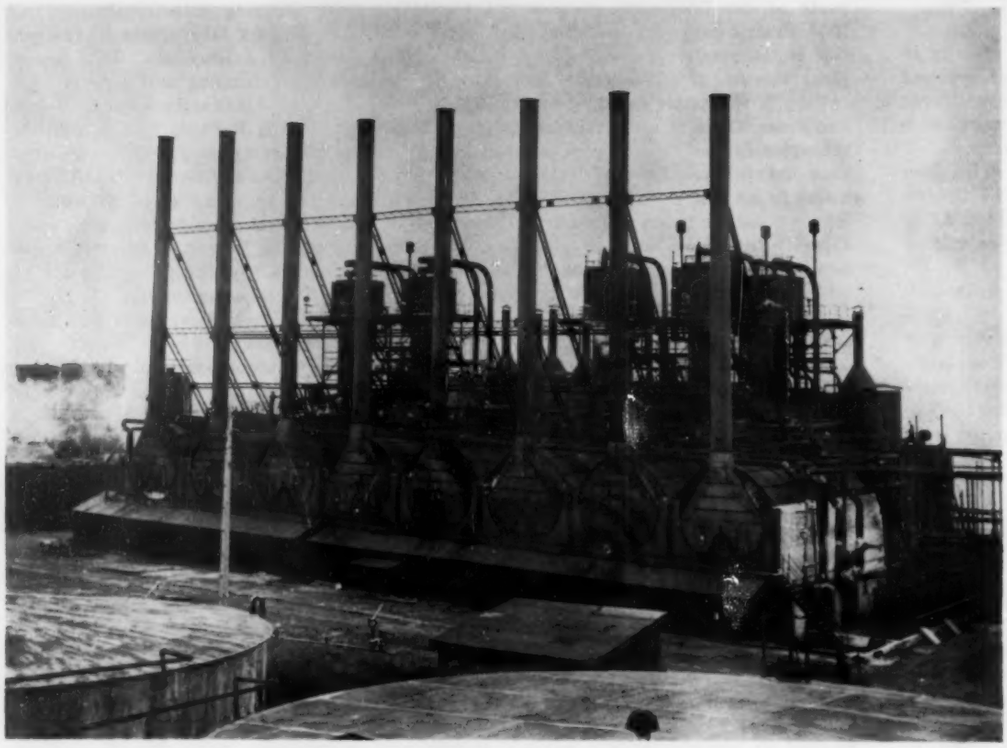
Husky Oil & Refining Ltd. is continuing the modernization and enlargement of its asphalt plant at Lloydminster, Alberta. In 1953 the company spent $485,000 to build a catalytic gasoline reformer, a new vertical asphalt blow still, an asphalt specialty plant, a new fire protection system and new fractionating towers.

This year Husky's capital expenditures on new equipment will total $600,000. Included in the program is a new furnace and distillation unit with a capacity of 4,000 b/d, two new asphalt blow stills, a 1,000 b/d diesel fuel desulfurization unit, two road oil heaters and additional storage. A new catalyst chamber is being added to the reformer which will increase its capacity by 500 b/d. Control of the plant will be centralized in a new control room to be ready for use on August 1, at which time all of the other projects are expected to be complete.

North Star Oil Ltd., Winnipeg, has announced plans for the erection of a new 12,000 b/d refinery at St. Boniface, Man. The plant will include a fluid cat cracker and a cat poly unit. It will produce LPGas as well as the usual liquid fuels. North Star now has a 5,000 barrel refinery on another site at St. Boniface



This "combination unit" will be the only piece of processing equipment to survive when Imperial Oil rebuilds its Imperoyal refinery at Halifax. The crude section will be replaced by an atmospheric and vacuum distillation unit with a daily capacity of 41,625 barrels. The cracking section will undergo major changes.



Batch stills for crude oil which were installed in Imperial Oil's Imperoyal refinery at Halifax in 1916 are to be dismantled. The stills were pressed into service during the last war to help supply the Allied fleets and Atlantic convoys.

which is equipped with a 1,000 b/d Dubbs thermal cracker and a 1,100 b/d reformer. Crude is obtained through the Interprovincial line.

Consumers Cooperative Refineries at Regina, Sask., is completing a major expansion program. Included in the job is a 12,000 b/sd crude distillation unit, a 6,500 b/sd vacuum still, a 5,000 b/sd UOP fluid cat cracker, a 500 b/sd cat poly unit, gas recovery and LPGas plant.

The Trans Mountain oil pipe line from Edmonton across the Rocky Mountains has stimulated refinery construction on the Pacific Coast and soon will make that area in both British Columbia and Washington and Oregon independent of product imports from California and elsewhere. Still capacity in British Columbia had been largely unchanged at about 28,500 b/d for many years prior to the pipe line completion. Last year completion of Imperial's Ioco expansion and partial completion of the Shell plant at Burrard Inlet raised British Columbia capacity to 45,350 b/d. Royalite Products Ltd. and Standard Oil Co. of British Colombia Ltd. will complete new plants this year which will raise B.C. capacity to 60,000 b/d.

Similar activity has been begun across the border in Washington state. There General Petroleum Corp. is erecting a 28,000 b/d refinery to operate on Canadian crude and Shell will soon begin building a 50,000 b/d plant at Anacortes, 75 miles north of Seattle.

Imperial's Ioco plant was the first to be completed in British Columbia to be served by Trans Mountain. The $13.5 million project included erection of the first fluid cat cracker on the Canadian Pacific Coast and an increase of 10,500 b/d in crude capacity from 12,000 to 22,500 b/d. Operations were formally begun on September 16, 1953.

The multimillion dollar expansion program begun in the fall of 1952 at Shell Oil Company of Canada's Vancouver refinery located on Burrard Inlet in British Columbia has now been completed.

The expansion, which brought the crude capacity of the refinery up to 15,000 barrels daily, was carried out in two stages by Fluor Corp. The first stage, involving revisions of the existing topping plant facilities together with associated treating equipment, was completed to coincide with the opening of the Trans Mountain Oil Pipe Line in the fall of 1953. Shell of Canada holds a substantial interest in the $82 million pipe line which is now bringing Alberta crude oil into the Vancouver refinery. Prior to the opening of the line, crude refined was imported by tanker from California.

The second stage of the expansion, completed early in 1954, included a vacuum flasher, a fluid catalytic cracking unit of latest design and a gas recovery plant as well as polymerization and treating units. New office buildings and shops have also been constructed and tank storage for refined products has been increased by 300,000 barrels.

The expanded refinery provides British Columbia with aviation fuel, motor gasoline, diesel and heating oils, bunker fuel, asphalt and other products.

The original Shellburn refinery, as it is commonly called, was built in 1932 and had a capacity of 5,000 b/d. In 1946 the company carried out an expansion program and again two years later Shellburn was enlarged with installation of thermal cracking and polymerization units.

Last month Royalite Products Ltd., subsidiary of Royalite Oil Co. Ltd., began partial operation of a new 5,000 b/d refinery at Brockelhurst on the outskirts of the city of Kamloops. First unit to be completed was the crude still. Meanwhile, work is going forward on a 1,410 b/d UOP fluid cat cracker, a cat poly unit and gas concentration plant. Completion of these units will be early in 1955. A Petreco desalter with 6,000 b/d capacity is being installed. Overall cost of the project is estimated at $6 million. Primary contractor on the job is Caribou Engineering Co. Ltd. of Vancouver. Foster Wheeler is supplying and erecting the boiler plant and Fluor Corp. the cooling tower.

Standard Oil Co. of British Columbia Ltd. has heretofore operated an 8,350 b/d plant at North Burnaby. Adjacent to the site of this plant, Standard has begun the erection of a new $10 million refinery on a 75-acre plot. The new plant will have a crude capacity of 11,000 b/d and will be linked to Trans Mountain by a 5-mile feeder. Included in the plant will be cat cracking and poly units, two-stage distillation and the usual auxiliaries. Completion is expected late in 1954.

CENTURY OILS LIMITED

301, Royal Bank Building,
WINNIPEG, MANITOBA

601, Leeson-Lineham Building,
CALGARY, ALBERTA

MONARCH OILS LIMITED

601, Leeson-Lineham Building

CALGARY, ALBERTA

FURTHER DEVELOPMENT OF CENTURY'S CROWN LEASES IN THE ARMELGRA-SCOPE-ENCHANT AREA

Press reports have stated that Trans-Canada's terminal for its Ontario-Quebec pipe line is to be at Princess, Alberta. Following the issue of permit, gas development, with a view to enlarging the province's reserves, is expected to be carried out on a major basis, particularly in Southern Alberta.

Century's holdings in the general Armelgra-Scope-Enchant area, which exceed 9,000 acres of Crown Leases, and extend into five townships, are most favorably situated, both as to gas success already established there, and also as to possible closeness to the line's terminal.

Century's recent dual zone gas success, from both the Milk River and Cretaceous sands, created by the Calcana-Century-Monarch team, is to be followed by a second well, one mile due south of this discovery. The second well—Calcana-Century-Monarch 2—will start to drill in lsd 16 of 21-13-14w4 as soon as weather conditions permit.

The general development of this large holding in Southern Alberta has an important place in Century's programme of activities for the year.

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For full information and colorful 100 page booklet write: E. H. Parsons, Co-ordinator of Industrial Development, City Hall, Calgary, Alberta.

THE CITY OF CALGARY

Driller using special bit to cut through hard layer of frost at muskeg surface in Loon Lake, Alberta, Canada, operations of the Socony-Vacuum Oil Co., Inc., where frost ranges from few inches to several feet.

Drilling operations in 1953

TOTAL WELLS DRILLED—WESTERN CANADA—1953 AND 1952

	N. W. T.			B. C.			ALTA.			SASK.			MAN.			WEST. CAN.		
	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total
1953																		
Oil	0	0	0	0	0	0	742	76	818	271	69	340	64	3	67	1077	148	1225
Gas	0	0	0	0	20	20	74	89	163	9	14	23	0	0	0	83	123	206
Dry	0	6	6	0	19	19	119	312[3]	431	38	275	313	2	21[3]	23	176	633	809
TOTAL	0	6	6	0	39	39	935	477	1412	318	358	676	66	24	90	1336	904	2238

	N. W. T.			B. C.			ALTA.			SASK.			MAN.			WEST. CAN.		
	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total
1952																		
Oil	0	0	0	0	0	0	877	96	973	156	44	200	32	4	36	1065	144	1209
Gas	0	0	0	0	10	10	63[3]	74[5]	137[4]	14	11	25	0	0	0	16[5]	156[3]	172
Dry	0	12	12	0	5	5	123[4]	381	504	11	228	239	1	35	36	140[5]	661	801
TOTAL	0	12	12	0	15	15	1063	551	1614	181	283	464	33	39	72	1221	961	2182

[1] 14 Service wells not included. [2] 1 Service well not included. [3] 2 Condensate wells included. [4] 4 Condensate wells included. [5] 5 Service wells not included.

EXPLORATORY DRILLING in Canada in 1953 was almost identical with the previous year in number of wells sunk. Footage drilled was greater last year than in 1952. The success ratio was somewhat higher.

Data in the accompanying tabulations dealing with 1953 drilling operations in Western Canada were prepared by Dr. A. W. Nauss, president of Scurry Oils Ltd., and P. J. Toulgoet of Link, Downing and Cooke Ltd. Compilation was for Dr. Frederic H. Lahee of Sun Oil Co., who will publish the data in the June issue of the Bulletin of the American Association of Petroleum Geologists as part of his annual survey of exploratory drilling.

In 1952, 988 exploratory wells were drilled, of which 737 or 74.6 percent were dry and 251 or 25.4 percent were producers. Of the producers, 147 were oil wells, 102 were gas wells and two condensate producers.

In 1953 the number of exploratory wells was 989, an increase of one. Dry holes totaled 722, a drop of 15. Producers rose from 16 to 267 and the success ratio was up to 27 percent. A greater proportion of the successful wells were gassers. Oil discoveries totaled 145, two less than in 1952, while gassers increased 20 to 122.

The exploratory drilling summarized above includes outposts, new pool wildcats and deeper pool tests as well as rank or new field wildcats. Examining new field wildcats exclusively, it is observed that the success ratio is much lower and tended to fall in 1953. Of the 733 rank wildcats drilled, there were 633 dry holes and 100 producers. Dry holes constituted 86.4 percent of all wells drilled and producers 13.6 percent. Only 6.8 percent were oil wells while 7.7 percent were gas wells. An accompanying tabulation lists 1953 discoveries in each province.

In 1952 the success ratio was somewhat better in new field wildcatting. Of the 733 rank wildcats drilled, 135 or 18.4 percent were producers, and 598 or 81.6 percent were dry.

Exploratory footage drilled in Canada in 1953 totaled 3,909,864 feet compared with 3,667,085 feet the previous year. While the number of holes sunk was virtually unchanged, the footage rose 6.5 percent. Deeper drilling was done in both Western and Eastern Canada.

In Eastern Canada the average well was drilled to 1,466 feet in 1953 and 1,451 feet the previous year.

In Western Canada the average exploratory well was drilled to 4,108 feet in 1953 compared with 3,932 feet in 1952.

There were 1,319 development wells exclusive of service wells drilled in western Canada in 1953 to a total depth of 5,286,619 feet, an average depth of 4,000 feet. Development drilling by provinces follows:

	No. WELLS	TOTAL FOOTAGE
Alberta	935	4,209,251
Saskatchewan	318	918,320
Manitoba	66	159,048
Total	1,319	5,286,619

Total footage of development, service and exploratory wells in Western Canada in 1953 was 9,139,852. Due to the new discoveries late in the year, it is anticipated that development drilling this year will be quite active. Wildcatting still is continuing in an effort to find more oil in the vast area untested by the drill.

The tabulation of exploratory drilling in Canada in 1953 on the following page is further amplified on pages 162, 164, and 166 with a list of successful new-field wildcats for 1953 in both Eastern and Western Canada.

COMPARISON OF 1953, 1952, 1951 AND 1950 NEW FIELD WILDCATTING RESULTS

Year		COMPLETED DISCOVERIES					COMPLETED WILDCATS			
		Total	Gas	Oil	Rate Gas	Rate Oil	Total	Rate Gas	Rate Oil	% Total
1953	Alberta	61	40	21	66%	34%	292	13.7%	7.1%	20.8%
	Saskatchewan	26	4	22	15%	85%	273	1.5%	8.0%	9.5%
	British Columbia	7	7	0	100%	0	23	30.0%	0	30.0%
	Manitoba	2	0	2	0	100%	21	0	9.5%	9.5%
	N. W. T.	0	0	0	0	0	6	0	0	0
	Western Canada	96	51	45	53%	47%	615	8.3%	7.3%	15.6%
	Eastern Canada	2	1	1	50%	50%	59	1.7%	1.7%	3.4%
	TOTAL CANADA	98	52	46	53%	47%	674	7.7%	6.8%	14.5%
1952	Alberta	94	55	39	59%	41%	394	13.9%	9.9%	23.8%
	Saskatchewan	31	9	22	29%	71%	239	3.8%	9.2%	13.0%
	British Columbia	3	3	0	100%	0	6	50.0%	0	50.0%
	Manitoba	3	0	3	0	100%	35	0	8.6%	8.6%
	N. W. T.	0	0	0	0	0	12	0	0	0
	Western Canada	131	67	64	51%	49%	686	9.8%	9.3%	19.1%
	Eastern Canada	4	4	0	100%	0	47	8.3%	0	8.3%
	TOTAL CANADA	135	71	64	53%	47%	733	9.7%	8.7%	18.4%
1951	Alberta	71	48	23	65%	35%	305	16.0%	7.6%	23.6%
	Saskatchewan	5	3	2	60%	40%	49	6.1%	4.2%	10.2%
	British Columbia	3	3	0	100%	0	14	21.4%	0	21.4%
	Manitoba	1	0	1	0	100%	10	0	10.0%	10.0%
	Western Canada	80	54	26	68%	32%	378	14.3%	6.9%	21.2%
	Eastern Canada	1	0	1	0	100%	11	0	9.1%	9.1%
	TOTAL CANADA	81	54	27	67%	33%	389	13.9%	6.9%	20.8%
1950	Alberta	38	18	20	56%	44%	193	9.3%	10.4%	19.7%
	Saskatchewan	4	0	4	0	100%	63	0	6.3%	6.3%
	British Columbia	0	0	0	0	0	8	0	0	0
	Manitoba	0	0	0	0	0	6	0	0	0
	Western Canada	42	18	24	45%	55%	270	6.7%	8.9%	15.6%
	Eastern Canada	2	2	0	100%	0	50	4.0%	0	4.0%
	TOTAL CANADA	44	20	24	45%	55%	320	6.2%	7.5%	13.7%

Drilling Operations in 1953

(Continued on page 162)

A winter road almost 250 miles long and wide enough to enable Imperial Oil to move in heavy drilling equipment before the spring thaw was required to drill the House Creek well deep in the bushland north and east of Peace River, Alberta.

EXPLORATORY DRILLING IN CANADA IN 1953

Well Classification	Oil		Gas		Total Producers		Dry Holes		Grand Total	
	Number	Footage	Number	Footage	Number	Footage	Number	Footage	Number	Footage
Alberta										
Outposts	37	163,171	41	143,206	78	306,377	60	208,950	138	515,327
New-Pool Wildcats	5	15,312	3	10,271	8	25,583	14	62,402	22	87,985
Deeper-Pool Tests	3	3,599	1	588	4	4,187	17	18,037	21	22,224
Shallower-Pool Tests	3	14,730	0	0	3	14,730	0	0	3	14,730
New-Field Wildcats	21	120,387	40	211,247	61	331,634	231	1,078,075	292	1,409,709
TOTAL	69	317,199	85	365,312	154	682,511	322	1,367,464	476	2,049,975
British Columbia										
Outposts	0	0	13	66,502	13	66,502	0	0	13	66,502
New-Field Wildcats	0	0	7	50,426	7	50,426	16	94,162	23	144,588
TOTAL	0	0	20	116,928	20	116,928	16	94,162	36	211,090
Manitoba										
Outposts	0	0	0	0	0	0	1	3,937	1	3,937
New-Pool Wildcats	1	2,026	0	0	1	2,026	2	7,197	3	9,223
New-Field Wildcats	2	4,640	0	0	2	4,640	19	61,963	21	66,603
TOTAL	3	6,666	0	0	3	6,666	22	73,097	25	79,763
Northwest Territories										
New-Field Wildcats	0	0	0	0	0	0	6	13,222	6	13,222
Saskatchewan										
Outposts	33	117,833	3	6,166	36	123,999	17	61,942	53	185,941
New-Pool Wildcats	12	36,263	6	17,466	18	53,729	13	44,406	31	98,135
Deeper-Pool Tests	1	484	0	0	1	484	0	0	1	484
Shallower-Pool Tests	1	3,607	0	0	1	3,607	0	0	1	3,607
New-Field Wildcats	22	87,169	4	8,976	26	96,145	247	1,018,101	273	1,114,246
TOTAL	69	245,356	13	32,608	82	277,964	277	1,124,449	359	1,402,413
Total Western Canada										
Outposts	70	281,004	57	215,874	127	496,878	78	274,829	205	771,707
New-Pool Wildcats	18	53,601	9	27,737	27	81,338	29	114,005	56	195,343
Deeper-Pool Tests	4	4,083	1	588	5	4,671	13	18,037	18	22,708
Shallower-Pool Tests	4	18,337	0	0	4	18,337	0	0	4	18,337
New-Field Wildcats	45	212,196	51	270,649	96	482,845	519	2,265,523	615	2,748,368
TOTAL	141	569,221	118	514,848	259	1,084,069	639	2,672,394	898	3,756,463
Newfoundland										
New-Field Wildcats	0	0	0	0	0	0	2	3,920	2	3,920
Ontario										
Outposts	1	420	0	0	1	420	3	2,815	4	3,235
New-Pool Wildcats	2	650	2	2,907	4	3,557	21	28,844	25	32,401
Deeper-Pool Tests	0	0	1	12	1	12	2	897	3	909
New-Field Wildcats	1	1,831	1	1,855	2	3,686	53	104,463	55	108,149
TOTAL	4	2,901	4	4,774	8	7,675	79	137,019	87	144,694
Quebec										
New-Field Wildcats	0	0	0	0	0	0	2	4,787	2	4,787
Total Eastern Canada										
Outposts	1	420	0	0	1	420	3	2,815	4	3,235
New-Pool Wildcats	2	650	2	2,907	4	3,557	21	28,844	25	32,401
Deeper-Pool Tests	0	0	1	12	1	12	2	897	3	909
New-Field Wildcats	1	1,831	1	1,855	2	3,686	57	113,170	59	116,856
TOTAL	4	2,901	4	4,774	8	7,675	83	145,726	91	153,401
TOTAL CANADA ALL EXPLORATORY	145	572,122	122	519,622	267	1,091,744	722	2,818,120	989	3,909,864

From "Exploratory Drilling in 1953," by Frederic H. Lahee. To be published in June number of Bulletin of American Association of Petroleum Geologists.

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Drilling Operations in 1953

(Continued from page 160)

SUCCESSFUL NEW FIELD WILDCATS—WESTERN CANADA—1953

ALBERTA 21 OIL Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Acheson (East)	Cal. Standard	7-6-53-25W4	30/10	5,654	4,121	Acheson (East)
Acme	Delhi Banff 1	13-22-29-25W4	6/7	7,204	....	Acme
Baxter Lake	Leo 1	7-11-47-5W4	26/2	1,870	....	Leo
Camrose (South)	Bay 6-11	6-11-46-20W4	31/1	5,225	3,239	Battle
Cold Lake	H.H.C. 1-8	8-29-62-2W4	27/3	1,060	....	Cold Lake
Elk Island	Old Settlers Elk Island 1	16-17-55-20W4	8/4	3,378	3,368	Elk Island
Erskine	Mitmor-Merrill & Assoc. 5-1	5-1-39-21W4	16/1	5,409	....	Erskine
Ewing Lake	Gulf C.P.R. 14	14-23-37-21W4	7/1	5,552	5,524	Ewing
Fairydell	Union Citation 3-21	3-21-57-24W4	14/2	4,078	....	Fairydell
Grassy Lake	Glenphyll 1	7-10-11-13W4	6/2	3,091	....	Grassy Lake
Homeglen	Cal. Std. 3-29	3-29-43-1W5	21/3	8,983	8,031	Homeglen-Rimbey
Jenner	Western Mayrath 18-4	4-18-21-8W4	9/4	4,336	3,250	Jenner
Joffre	Can. Sup. Unit Morton 9-19	9-19-38-25W4	5/9	6,939	4,920	Joffre
Pembina	Socony Seaboard 1	4-16-48-8W5	15/5	9,425	6,400	Pembina
St. Albert	Stanolind-Imperial Unit 1	3-1-54-26W4	3/1	4,743	4,710	St. Albert
Samson	Western Union 9-11	11-9-44-24W4	16/4	6,648	4,924	Samson
Samson Lake	Seaboard Gulf 1	1-20-43-22W4	28/2	5,381	....	Samson Lake
Springburn	Shell Imperial 1	14-34-80-17W5	6/2	6,877	....	Springburn
Sturgeon Lake	Amerada Crown RF3-19	5-19-69-22W5	16/3	8,880	....	S. Sturgeon Lake
Sylvan Lake	Seaboard 10-4	10-4-41-3W5	8/11	9,820	6,237	Sylvan Lake
Wood River	Texaco A-1	9-6-43-23W4	13/9	5,914	5,205	Wood River

ALBERTA 40 GAS Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Atim	Imperial	2-7-54-26W4	20/2	3,397	....	Atim
Atlee	High Crest Can. Oil & Gas Reser.	3-34-21-7W4	6/12	4,092	3,362	Atlee
Bawlf	Phillips Neilson 1	10-30-46-17W4	2/2	4,730	3,558	Bawlf
Beaverhill Lake	Texaco-Merill Calvan 11-21	11-21-52-19W4	12/1	4,550	3,370	Beaverhill Lake
Big Valley (West)	Gulf C.P.R. Rich #9	9-7-35-21W4	1/9	6,933	4,905	Big Valley West
Calmette	Imperial	6-29-58-25W4	15/9	2,770	....	Calmette
Chisholm-Hondo	Dominion Sunbeam 1	5-15-67-1W5	21/7	5,093	3,353	Chisholm-Hondo
Donalda	C.P.R. Dennis 3 (Gulf)	3-35-42-19W4	7/3	5,800	3,695	Donalda
Drumheller	Stockton Socony C.P.R. 1	10-22-28-20W4	7/2	5,905	4,756	S. Drumheller
Dyberg	Texaco-Cal. Std. Dyberg 1	8-15-44-23W4	26/11	6,501	2,246	Dyberg
Enchant	Texaco A-1	14-23-13-17W4	29/1	3,454	....	Enchant
Evergreen	Texaco-Gulf-H.B. 1	16-29-37-3W5	17/10	9,443	7,360	Evergreen
Eyremore	Royalite Anglo 1	4-21-18-18W4	14/2	5,440	....	Eyremore
Flatbush	Gt. Plains N.B.D. 16-9	16-9-66-1W5	30/3	3,908	2,855	Flatbush
Flat Lake	Shell 4	11-34-66-19W4	15/1	2,320	1,682	Flat Lake
Fork Lake	Scurry-Banff-Rainbow 1	3-28-64-12W4	28/7	3,080	2,075	Fork Lake
Halkirk	Anglo American 1	9-28-39-16W4	26/2	4,398	4,165	Halkirk
Heathdale	Dragon Marwayne 13-21	13-21-27-9W4	29/5	3,956	3,350	Heathdale
Hercules	H.B. 1	1-2-52-23W4	16/7	4,080	3,896	Hercules
Hughenden	Naco 4-29	4-29-40-7W4	16/12	3,798	2,788	Hughenden
Killam	Marwayne Dragon 5-29	5-29-42-13W4	2/2	3,479	3,064	Killam
Kessler	Mill City-Sharpless Kroy Sweetgrass 1	13-27-38-8W4	13/3	3,329	2,525	Kessler
Mannville	Canpet Fina 3	11-30-51-8W4	23/7	2,475	2,350	Mannville
Manyberries	West. Can. South 13-20	13-20-3-5W4	6/7	3,674	....	S. Manyberries
Munson	Gulf 5-9	5-9-30-20W4	29/11	5,750	4,441	Munson
North Stettler	Husky-Gulf-Can. Sup. 1	14-28-39-20W4	30/12	6,135	3,925	N. Stettler

(Continued on page 164)

C. E. Lightfoot

Lightfoot Joins Lummus

The Lummus Co., designing engineers and constructors for the petroleum and chemical industries, announces the association of C. E. Lightfoot with the firm. For the past 25 years, Mr. Lightfoot has been active in the chemical industry, in chemical economics, sales, marketing and consulting.

Shell Agricultural Chemicals Division

Shell Chemical Corp. changed the name of its Julius Hyman & Co. division to the Agricultural Chemicals Division effective January 1. The division, with headquarters in Denver, Colorado, will continue to market aldrin, dieldrin, endrin, DD and other insecticides and agricultural chemicals. F. W. Hatch will continue as manager, with J. J. Lawler as sales manager.

Book Review

Condensate Well Corrosion, by the NGAA Condensate Well Corrosion Committee; published 1953 by Natural Gasoline Association of America, Tulsa, Okla.; illustrated; 203 pages; $6.00.

Some ten years ago the attention of operators of deep high pressure condensate wells in the Gulf Coast area was called to the seriousness of the corrosion of tubing in these wells. Many papers have been written on the subject and the NGAA appointed a committee composed of metallurgists, chemists, and engineers to study and report on the chemical, physical and economic aspects of the matter. This committee has now turned in its report, in which is collected an impressive amount of information. They determined the causative agents, the influence of metallurgical factors, the effects of flow rate and temperature, and have assisted in developing methods for detecting, measuring and locating corrosion in individual wells and methods for counteracting its unwelcome results.

There are 17 chapters, each written by one or more specialists. The chapter dealing with the economics of gas condensate well corrosion will surely fix the attention of engineers in this field and convince them of the importance of the committee's findings and recommendations. While the studies were confined to gas-condensate wells, the treatments and curves discovered are applicable to other divisions of the petroleum industry where carbon dioxide or wet acids are the causative agents.

R. T. McCoy

R. T. McCoy, 63, recently retired former manager of the African marketing department of California Texas Oil Co. Ltd., died on March 26 in New Jersey. A pioneer in the development of foreign markets, Mr. McCoy had completed over 35 years in the oil industry with Caltex or affiliate companies. His assignments took him to China, Australia and South Africa. He was head of the Caltex African department for several years.

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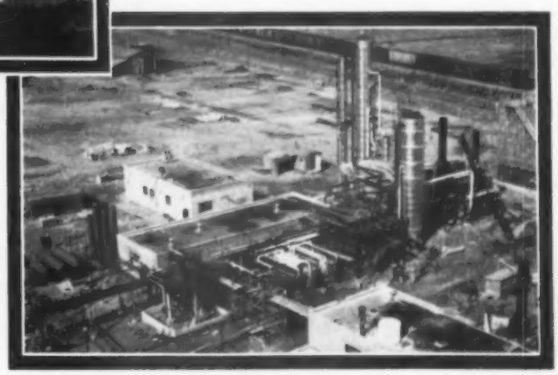
PRODUCTION
PIPELINES
REFINING
NATURAL GAS
PROPANE
SULPHUR



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Drilling Operations in 1953

(Continued from page 162)

Ponoka	Texaco A-1	3-24-43-26W4	27/7	7,960	5,290	Ponoka
Pouce Coupe	Can. Northern 1	1-12-78-13W6	23/10	6,010	....	S. Pouce Coupe
Rollyview	Union-Imperial Kneller 4-5	4-5-50-23W4	20/12	5,696	4,346	Rollyview
Rossington	Sinclair Baxandall	4-8-60-1W5	24/8	2,690	....	Rossington
Scope	Calcana Century Monarch	16-28-13-14W4	21/7	2,481	....	Scope
S. Westerose	Cal. Std. 15-11	15-11-45-1W5	27/6	7,725	....	S. Westerose
Sturgeon Lake	Amerada Crown "V" F32-13	10-13-70-25W5	27/7	10,030	4,998	Sturgeon Lk.
Sturgeon Lake	Amerada Crown XF 21-13	14-13-68-25W5	17/10	10,430	6,436	Sturgeon Lk.
Sullivan Lake	C. P. R. Giere 1	6-15-33-13W4	10/3	4,451	....	Sullivan Lk.
Sylvan Lake	Cal. Std. 5-16	5-16-38-2W5	25/4	9,498	6,555	Sylvan Lake
Three Hills	Amurex Calvan 1-3	3-30-35-25W4	2/12	8,000	6,294	Three Hills
Wainwright	American North land 1-B-7	7-14-45-7W4	21/7	2,224	....	Wainwright W.
Wildunn	Imperial	3-15-29-14W4	17/1	4,630	4,335	Wildunn
Winchell Coulee	Delhi Britalta 1	10-24-29-6W5	16/12	10,892	5,243	Winchell Coulee

SASKATCHEWAN 22 OIL

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Antelope Lake	Socony Woodley Southern 5-3	3-5-16-18W3	6/6	4,030	....	Antelope Lk.
Buffalo Coulee	Can. Southern #9-30	9-30-32-24W3	28/1	2,740	....	Buffalo Coulee
Cook Lake	Can. South New Superior 1	11-32-31-21W3	6/11	2,707	2,250	Cook Lake
Dewar	Canada Southern 6-14	6-14-31-26W3	8/5	2,900	2,433	Dewar
Dewar South	Imperial 7-25V	7-25-30-26W3	5/12	2,575	....	Dewar South
Dollard	Tidewater 5-21	5-21-7-20W3	14/6	4,904	....	Dollard
Frontier	Tidewater Crown #1	13-21-3-20W3	23/1	4,751	....	Frontier
Forget	Tidewater #1	2-11-9-7W2	15/1	3,958	....	Forget
Forget	Williston Bobjo #1-19	1-19-9-6W2	8/9	3,990	....	Forget
Gull Lake	Gridoil Anglo Am. Gull L.9-14A	9-14-13-19W3	6/7	3,941	....	Johnson Pool (Gull Lake)
Leon Lake	Tidewater 3-15	3-15-8-19W3	4/12	4,556	....	Leon Lake
Loomis	Tidewater Crown #1	5-1-3-21W3	19/3	4,825	....	Loomis
Midale	Kilgore Leytze Palmer 16-35	16-35-5-11W2	31/10	5,245	....	Midale
Midale	Shell A-7-18	7-18-6-10W2	29/5	5,080	4,631	Midale
Minard	Shell A-16-4	16-4-5-7W2	15/12	4,900	4,865	Minard
Java	Tidewater Crown #1	16-29-15-15W3	23/2	3,400	3,289	Java
Midway	Socony Woodley South S.E. 3-1	1-3-14-19W3	11/8	3,790	....	Midway
Marengo	Phillips Husky 1	10-26-28-27W3	19/12	3,177	2,958	Marengo
North Premier	Socony W.S. North 30-4B	4-30-15-18W3	30/1	4,118	....	N. Premier
Rapdan	Tidewater Crown #1	15-2-4-20W3	19/2	4,700	....	Rapdan
Smiley	Imperial 7-15V	7-15-31-25W3	19/9	2,386	....	Smiley
Stoughton	Sohio 4-13	13-4-9-8W2	17/12	4,456	....	Stoughton

SASKATCHEWAN 4 GAS

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Clearsite	Amurex Can. South. Good 1-11	11-24-13-20W3	12/12	1,561	....	Clearsite
Glidden	Phillips Husky 1	7-14-27-14W3	25/11	3,010	2,283	Glidden
Maple Creek	Amurex Can. South. Odenback 1-10	10-23-14-30W3	6/10	1,615	....	Maple Creek
Smiley	Canada Southern 11-22	11-22-31-25W3	4/4	2,790	2,361	Smiley

BRITISH COLUMBIA 7 GAS

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
J. B. White & Sun Oil Co. Blueberry #1	Sun Oil Co.	Nr. MP. 111 Alaska Highway	1/7	4,892	....	N. Blueberry

(Continued on page 166)

H. P. Hearn

Halliburton Promotes Hosea Hearn

Hosea P. Hearn, veteran Halliburton Oil Well Cementing Co. employee, has been promoted from division manager to regional manager, to succeed Fred R. Whitten, who retired after 25 years with Halliburton.

Mr. Hearn formerly was California division manager at Los Angeles. In his new position he will transfer to Duncan to supervise the central region, which comprises the North Louisiana, Dallas, Central Texas, Lubbock, West Texas-New Mexico and California divisions. Mr. Hearn first was employed by Halliburton during school vacations and went to work full time in 1927 as a cementing truck driver. He was made a division manager at Dallas in 1947 and has since worked in the same capacity for the Rocky Mountain and California divisions.

Replacing Mr. Hearn at Los Angeles will be Tom L. Morton, who has been assistant division manager and division engineer at Houston for Halliburton's South Texas division.

Cross Licensing Agreement Signed

I. J. McCullough, president of the McCullough Tool Co., Los Angeles and Houston, announces the signing of a cross-license agreement with Byron Jackson Co., Welex Jet Services, Inc., and E. I. du Pont de Nemours Co. The agreement covers all of the jet process rights of both the McCullough Tool Co. and these companies. All litigation between McCullough and the other companies has been terminated.

Book Review

Graphic Problems in Petroleum Geology, by L. W. LeRoy and Julian W. Low; published 1952 by Harper and Brothers, New York 16, N. Y.; 8½ inches by 11 inches; 238 pages; $4.50.

This manual, said to be the first text-book work of its kind, is intended for use in the training of young men who are preparing for a career as petroleum geologists, either during their college years or when they get their first jobs with an oil company. These neophytes must naturally have a good basic education in geologic science, and they must also cultivate an ability to visualize underground circumstances and express what they see in maps and drawings sufficiently accurate for basing drilling programs that involve much expense at large risk. The authors base their teaching on the sound idea that nearly all problems in exploratory petroleum geology are solved in part, or entirely ,on the drawing board. Graphic methods, more than any others, promote straight thinking; complex relationships are thereby displayed so that the geologist can view the picture in its entirety.

The contents of the book consist of 31 practical problems embracing the fields of stratigraphy, structure, and oil field development, drawn from the experience of operating oil companies. The examples go from the simple to the complex; mastery of these graphic problems should enable the practicing geologist to construct an informative picture of nearly any situation that calls for a decision in oil field development.

UOP Builds New Laboratories

Universal Oil Products Co. has begun construction on a new research laboratory building at Des Plaines, Ill., adjacent to the recently built general offices. The new three-story research laboratory will match the existing Des Plaines building in design. Completion is planned for mid-year 1955.

To be certain of the best type of laboratory construction, it is reported that both officers of the company and a number of its research people visited recently-constructed research laboratories serving both the petroleum and chemical industries. The information secured through these visits resulted in the construction of several one-room laboratories, each incorporating different construction techniques and materials.

Construction of the new laboratory building is part of long range plans to bring the administrative, engineering, research and development functions together in one geographical location. While most of the groups now located at Riverside will move to the new laboratories, some of the company's operations will continue to function at that location.

New Polyethylene Process

Phillips Petroleum Company has developed an entirely new type of polyethylene plastic, which can be produced by a process requiring a substantially lower investment. A semi-commercial plant will be built at Adams Terminal on the Houston ship channel. After a sampling by plastic goods manufacturers of production from this new unit, the company anticipates building a large plant. The process operates at relatively low pressures of less than 500 pounds per square inch as contrasted with the extreme pressures of 15,000 to 30,000 pounds employed in present commercial polyethylene production.

Cooling Tower Institute Elects

Neal B. LauBach of Hudson Engineering Corp., Houston, has been elected president of the Cooling Tower Institute, the nation-wide association of manufacturers of industrial water cooling equipment. Other new officers are: Paul R. Hoffmann of Lilie-Hoffman Cooling Towers Inc., of St. Louis, vice-president; Clayton E. Pickup, The Fluor Corporation, Ltd., Los Angeles, secretary; and Robert R. Pabodie of United Cooling Tower Co., Kansas City, Mo., treasurer. President for the 1953 term was Leon T. Mart of The Marley Company, Kansas City, Mo.

Equipment Bulletin

Worthington Corporation, Harrison, N. J., has published a new bulletin, WP-1099-B42F, on oil field and pipe line equipment. The bulletin contains specification information on many types of pumps, including those for water flooding; steam turbines and turbine-generators; oil gas and dual fuel engines; "packaged" oil field compressors; various types of air and gas compressors; air tools; and mechanical power transmission equipment.

Glen Heads Johnston Pump

Hugh Glen has been elected president of Johnston Pump Company, effective April 1, 1954.

He succeeds Mrs. Thomas W. Simmons, who has resigned as president, but is still sole owner of the firm. Mr. Glen was formerly president of Emsco Derrick & Equipment Company.

Oronite Promotes Selby

J. H. Selby, formerly district manager for Oronite Chemical Co. in Dallas, Texas, has been named assistant to the eastern vice-president, H. E. Bramston-Cook. He will work out of the New York office. In his new capacity, Mr. Selby will be responsible for bulk sales of Oronite alkane and Oronite's detergent alkylate.

Mud Additive

Chemalloy Associates of Santee, Calif., have developed a metal powder for addition to drilling mud which is claimed to give an electrical reading which varies sharply from normal when oil becomes mixed with the drilling fluid. Developers suggest it as an additional tool for use in the location of pay strata. The metal powder is 80 percent zinc, to which other undisclosed metals have been added in the presence of muriatic acid.

New Catalog

McCullough Tool Company, Los Angeles 58, Calif., has just issued a new 40-page, illustrated general catalog. This 1954-55 catalog contains a complete description of the entire line of specialized tools and services available to the oil industry.

Packaged Compressor Plant

A new 660-hp packaged compressor plant, the largest ever offered as a complete package, has been announced by The J. B. Beaird Co., Inc., of Shreveport, La. Built around the Ingersoll-Rand 12SVG gas-engine-driven compressor, the new packaged plant is designed for single or multiple unit installation on gas pipe lines, gathering lines and gas lift systems. By using these 660-hp plants in banks, it is possible to install a compressor station with thousands of horsepower at the low cost per horsepower typical of packaged compressor plants.

In spite of its large capacity, the 12SVG packaged compressor plant may be transported on heavy oil field trailers directly to location. Like other Beaird-Ingersoll-Rand packaged compressor plants, the new model includes all necessary auxiliary equipment and controls.

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Drilling Operations in 1953

(Continued from page 164)

Blueberry #2	Sun Oil Co.	App. 4 miles S.E. of #1	30/8	4,655	....	Blueberry
N.F.A. Buick Creek #1	Texaco Exploration Co.	Lsd. 1, Sec. 31 Twp. 113	25/7	11,424	....	Buick Crk.
Pacific Ft. St. John #11	Pacific Petroleums Ltd.	4-23-86-21 W.6.M.	26/5	7,376	....	Unnamed
Pacific Ft. St. John #14	Pacific Petroleums Ltd.	13-1-84-20	4/3	7,314	....	Unnamed
Pacific Ft. St. John #33	Pacific Petroleums Ltd.	4-36-82-16	13/12	6,694	....	Unnamed
Pacific Pingel Creek #2	Pacific Petroleums Ltd.	5-26-81-18	17/11	8,071	....	Pingel Crk.

MANITOBA 2 OIL

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Roselea #9-28	McIvor Drilling Co., Ltd.	9-28-10-26 W.P.M.	4/8	2,101	2,077	Virden Roselea
Calstan Whitewater 12-16	Calif. Std. Co.	12-16-3-21	2/10	2,539	Confidential	Whitewater?

SUCCESSFUL NEW FIELD WILDCATS—EASTERN CANADA—1953

ONTARIO 1 OIL

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Warwick 12-3S	Imperial Oil Ltd.	Warwick Twp. Lot 12, Con. 3S	26/6	1,831	1,831	Warwick

ONTARIO 1 GAS

Well Name	Operator	Location	Completion Date	Total Depth Drilled	Total Completion Depth	Name of Field
Harwich 16-3 L.E.	Imperial Oil Ltd.	Harwich Twp. Lot 16 Con. 3 L.E.	14/4	1,855	1,581	Guilds

Lubrication Course At MIT

A special summer program in lubrication engineering, to give engineers in industry an opportunity to study the applications of new techniques and methods, will be held at the Massachusetts Institute of Technology from June 15 through June 25, 1954.

The program will be intended primarily for engineers responsible for lubrication maintenance and scheduling in industrial plants, but will be suitable also for chemists and others in the petroleum industry who wish to become better acquainted with the field of lubrication engineering, and for engineering students who wish to take advantage of the growing demand for men trained in this field.

Slim-Hole Blowout Preventor

Shaffer Tool Works, Brea, Calif., has developed a new Type 51 combination rotating blowout preventer and stripper for slim-hole drilling and production operations which is continuously on the job as long as the drill string is in the hole. When sudden emergencies occur, there is nothing to operate, no valves to set, nothing to remember or forget. The unit is said to maintain the same pressure tight protection whether the drill string is rotating or at rest, whether it is being raised or lowered in the well.

Geological Report

Geology of the Golden-Green Mountain Area, Jefferson County, Colorado is the title of Volume 49, No. 1 of the quarterly of the Colorado School of Mines, Golden, Colo. Price is $1.50. The 96-page volume, complete with 19 halftone photographs and a folder of detailed maps and tables, was originally written in 1953 as a doctoral thesis by Stanley O. Reichert, former instructor in geology at Mines, who is now research petroleum engineer of the U. S. Bureau of Mines, San Francisco.

BOOKS

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New Shell Holding Company

Canadian Shell Ltd., a new holding company, has recently opened offices at 600 University Avenue, Toronto. The formation of Canadian Shell is part of a simplification of corporate structures within the Royal Dutch/Shell group which has been under study for some years. It establishes in Toronto the head office of the company holding a major portion of the group's western hemisphere investments.

Included in Canadian Shell's wholly-owned subsidiaries are Shell Caribbean Petroleum Co., a New Jersey corporation, which owns beneficially approximately two thirds of the outstanding stock of Shell Oil Co. in the United States; Shell Canadian Exploration Co.; and Compania Shell de Venezuela Ltd. The company also holds a 50 percent interest in Shell of Canada.

Mr. Harold Wilkinson is president of the new firm and with his family has now taken up residence in Toronto. Mr. Wilkinson is a director of The "Shell" Transport and Trading Co. Ltd., The Shell Petroleum Co. Ltd., The Anglo-Saxon Petroleum Co. Ltd. and N. V. de Bataafsche Petroleum Maatschappij—all major units of the Royal Dutch/Shell Group.

Mr. Wilkinson joined the Asiatic (now The Shell) Petroleum Co. Ltd. in 1922. In February 1924 he went to Singapore and served there for four years before being transferred to The Shell Co. of South Africa, Ltd. In December 1931 he went to the United States where, some five years later, he was appointed president of Asiatic Petroleum Corp., New York.

Mr. Wilkinson was awarded the C.M.G. in the New Years Honor Lists for 1946, and in 1951 the United States Medal of Freedom with Bronze Palm for his outstanding service as British petroleum representative in Washington during World War II.

Senior staff at Canadian Shell are V. F. Graftstrom, vice president and secretary, previously manager, legal department, Asiatic Petroleum Corp., New York; E. N. Gray, assistant to president, who comes to Toronto from an executive post in Venezuela; B. H. Swinson, treasurer; and R. L. Fairbairn, assistant treasurer, both of whom held senior treasury positions with Asiatic. W. S. Rutherford, formerly with Shell of Canada, is office and personnel manager.

New Multi-Purpose Grease

A new multi-purpose automotive grease, Gulflex A, has been developed by the Gulf Oil Corp. and is now being distributed to jobbers, dealers and bulk plants throughout its marketing territory.

Gulflex A is composed of specially developed lithium soaps. The new grease is recommended for automotive chassis bearings, wheel bearings, water pumps, universal joints, and covered springs. It can also be used in grease lubricated bearings of boats, household equipment and power tools.

Sun To Add Cat Crackers

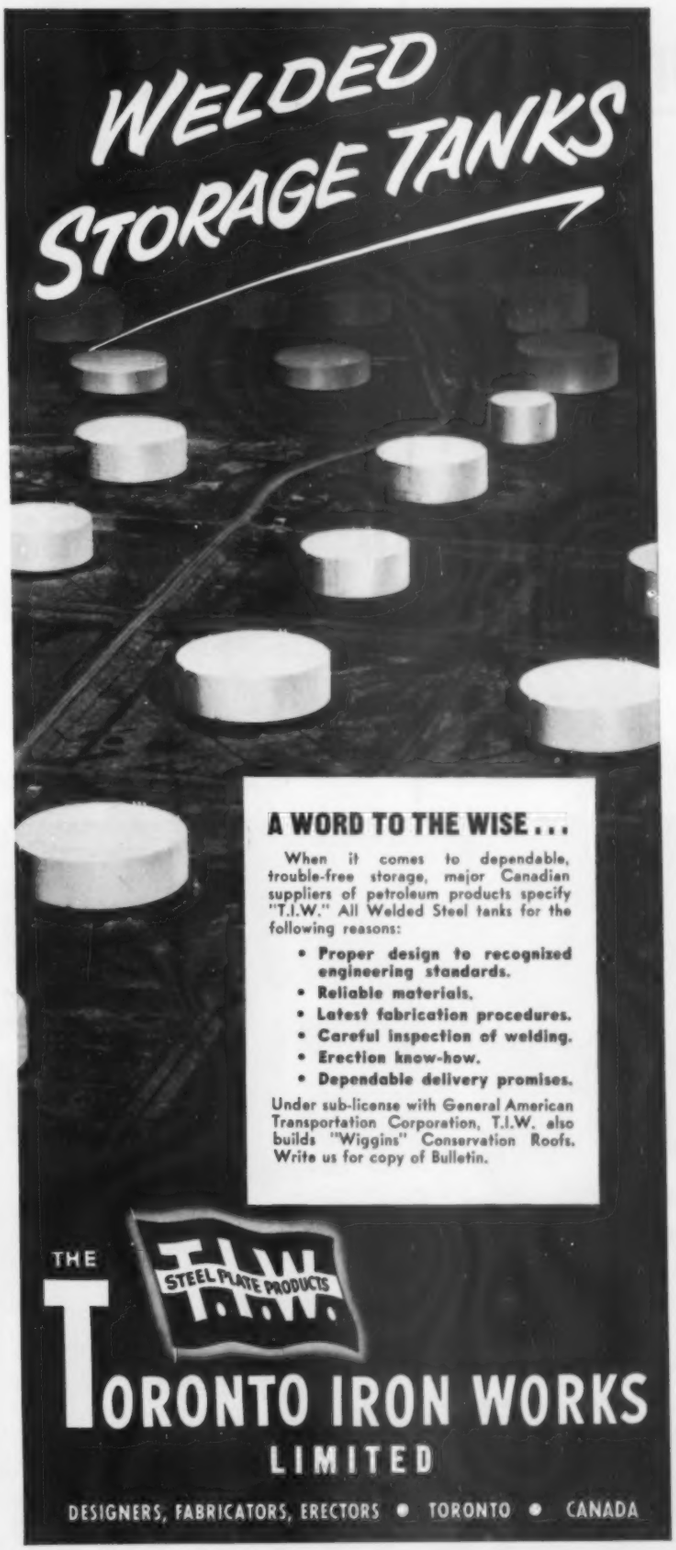
Sun Oil Co. will build new Houdriflow catalytic crackers at its Marcus Hook and Toledo refineries and an additional Houdriformer at Marcus Hook. Latest announcement by Sun is the letting of contracts to Catalytic Construction Co. for the erection of a 27,000 b/d Houdriflow unit and an 18,000 b/d Houdriformer at Marcus Hook.

Appoints Dealers

Herb J. Hawthorne, Inc., Houston, Texas manufacturers of "Blue Demon" exploration drill bits, has announced the appointment of Colorado Pump and Supply Co., 1449 South Broadway, Denver, Colo., and A-D Machinery Co., 251 West Commercial St., Elko, Nevada, as authorized Hawthorne dealers.

Dual Fuel Engine Bulletin

Worthington Corp. announces publication of a new bulletin on dual fuel engines known as Bulletin S-500-B57. Copies are available from the advertising and sales promotion department, Worthington Corp., Harrison, N. J.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One new White Rose station per week being opened

At night the station becomes a show case for display of accessories.

MARKING A MAJOR STEP forward in its marketing activities, Canadian Oil Companies Ltd. is at present busily engaged in opening a series of modern, new service stations in key areas from the Rockies to the Atlantic.

At the present time these White Rose "Ultra" service stations are coming into operation at the rate of about one a week. The first was opened during the latter half of 1953. By autumn of the present year it is expected that a total of 49 will have been completed.

These new service stations combine functional efficiency with beautiful lines and a striking color scheme. One fact which strikes even the most casual observer is that they have a distinctive, individual and instantly recognizable form and identity. For many years, colors of Canadian Oil have been red, yellow and white with green also being used in a supplementary way. The new design combines the use of these colors, but in modified shades and with a changed emphasis.

The service station identification sign has been altered, too. Formerly circular in shape, it now appears as a wedge. While the basic elements of the old sign (a white rose and the words "White Rose") have been retained, each has been completely redesigned. Highway recognition tests show that motorists can read and identify the new sign from much greater distances.

In the construction of the new White Rose Ultra service station, glass plays an extremely important role. There are a number of reasons why glass has been so freely used. In the first place, it has been employed to make sure that the operator has complete visibility at all times. Not only is the entire front of the station a veritable window, but also the use of glass between sales-room and work bays eliminates blind spots and assures instant attention for any motorist who stops for gasoline. Further, the sales-room's glass-enclosed front and side permit the most effective display of merchandise. In addition, the glass fronts of the work bays show the car owner what is going on there, automatically suggesting to him services for which he is likely to be a prospect.

The rear wall of the sales-room is of "peg board" construction to which movable metal shelf brackets may be readily attached, permitting any desired depth and arrangement of shelves.

Night lighting of the station has been carefully planned to cut down glare while at the same time presenting a brilliant, attractive appearance to the oncoming motorist.

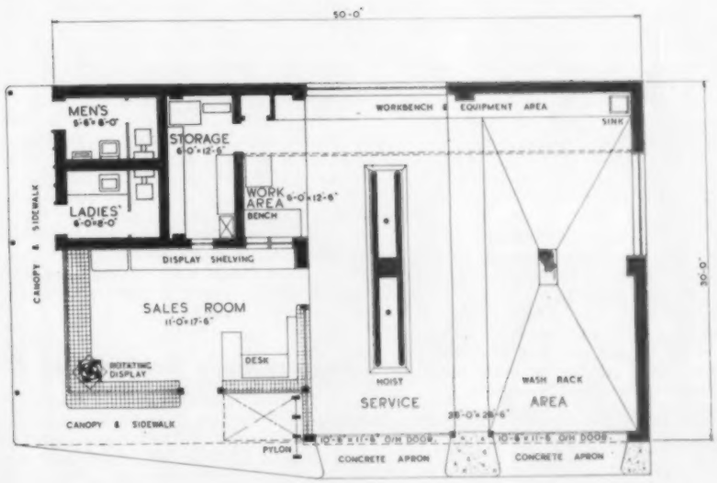
In the service areas every care has been taken to make "good housekeeping" easy and practical. A storeroom of ample size, work benches, storage cabinets, tire racks and other facilities provide every opportunity for neatness and cleanliness.

Good housekeeping is made easy and practical by clean interior design.

Important, also, in the new White Rose Ultra service stations are the smartly furnished restrooms. These have attractive wallpaper and fixtures and even an electric outlet to warm baby's bottle.

An added device for making it easy for motorists to recognize the new Ultra service stations is the checkerboard White Rose pylon above each new station. This pylon, constructed of steel, 24 feet high, has an open lattice design of 18-inch square plaques, on the face and back of which appears a White Rose. Since a service station is necessarily a low one story building, and is consequently of limited visibility, the pylon serves to take the place of height and thereby assists the motorist in identifying a member of the new group of Ultra stations. Another identification mark for the motorist is a distinctively-shaped sign bearing the words "White Rose" which is affixed to short posts rising from the roof of the station. This sign is modern in design and contributes markedly to the "new look" of the stations.

This "new look" has also been transmitted to all the company's packaged merchandise as well as to batteries sold under the company's brand name. Containers and labels have been redesigned to conform with the new trade mark and modified color scheme as, for that matter, have the company's tank trucks and all gasoline pumps as well.



The standard White Rose station has two bays, but a third can be added easily for super stations.

BRITISH OIL NEWS

By E. Lawson Lomax

One of the questions demanding increased attention in Great Britain is that of road safety and the relief of traffic congestion. There are some 94,100 miles of trunk and classified roads in England, Scotland and Wales, which is about 4.7 percent greater than was the case in 1910, while the total number of road-using vehicles has risen in the same period by over 3,000 percent. Apart from the resulting congestion, the physical state of the roads adds to the trouble, as maintenance was practically nil during the war and owing to past financial stringency has not yet caught up.

The British Road Federation has received estimates, made by highway authorities, which show that in respect of 39 349 miles of these roads, the amount required to make good arrears of maintenance in 1953 is £37,566,928 (over $105,000,000). On a proportional mileage basis, arrears of maintenance on the trunk and classified roads alone is now some £90 million, and this sum does not include secondary and purely country roads which in many cases are in very bad, if not dangerous, condition.

It is estimated that £1,000 million is spent annually in Great Britain in operating road transport, and an appreciable reduction in these costs could be made provided an adequate and well-maintained road system were provided.

Harbor Progress At Aden

Pile driving for all three jetties at Anglo-Iranian's new refinery port at Aden has been completed. The harbor consists of a 9,000-foot bund and a 4,000-foot breakwater, a finger jetty at which two tankers can berth and two T-head jetties each accommodating one tanker. Four supertankers will be able to berth simultaneously at these jetties. Other facilities are being provided to accommodate smaller craft. About four million of the six million cubic yards of sand required to be dredged to deepen the approach channel and harbor have been lifted, the whole of the sand being pumped ashore to cover an area of about 250 acres on which tankage and port buildings are being erected.

On the refinery site, Middle East Bechtel Corp. is using a large fleet of Leyland heavy-duty vehicles and industrial engines in road making and carrying supplies and equipment across the desert over largely unmade roads. These vehicles are working 20 hours per day, six days a week, and servicing is done in garages and machine shops as well as by mobile service vehicles, each vehicle being responsible for some 20 engines.

Geelong Refinery

Shell's new refinery at Geelong, 40 miles southwest of Melbourne, Australia, was officially opened on March 18 by Field Marshal Sir William Slim, the Governor General of Australia. A description of the refinery will appear in a forthcoming issue.

Manufacture of Polymers

During the past month three large manufacturing groups have made public their intention of developing the manufacture of rubber-like polymers in the United Kingdom similar to those already being made in the United States, and from when imports are restricted. The firms are: Imperial Chemical Industries, Monsanto Chemicals Ltd., and the Dunlop Rubber Co.

The products planned by ICI are based on butadiene, produced in its distillate cracking plant at Wilton, it being intended to use a variety of second components, including acrylonitrile and styrene. While some of these polymers will be similar to those made in the United States, others will be novel in composition and properties.

Pilot plant quantities should be available later this year, but it is not expected that the full scale plant will be in operation before 1956 with a capacity of about 10,000 tons per year.

Monsanto Chemicals Ltd. is one of the partners in Forth Chemicals Ltd. which was formed by this company with Anglo-Iranian Oil Co. Ltd. and the Distillers Co. Ltd. in 1950, the two latter being the partners in British Petroleum Chemicals Ltd. which is engaged in the manufacture of various chemicals from petroleum gases produced in its cracking plant at Grangemouth.

Monsanto announces that it has recently completed construction of a tonnage-scale pilot plant from which a range of styrene-butadiene resins will be available from July this year.

A large-scale plant to cost about £500,000 with an initial planned capacity of 4,000 tons per year will commence production in about two years.

Ford Chemicals has announced that it is increasing the capacity of its styrene plant, owing to the growing demand for that product in the manufacture of copolymers.

The Dunlop Rubber Co. states that as an essential step toward establishing a synthetic rubber industry in Britain, a plant for this purpose to cost about £500,000 ($1,400,000) is to be built at Fort Dunlop. Work on the site has begun. Like ICI and Monsanto, Dunlop says that the process has been developed in their research organization and that, now that the necessary raw materials, including butadiene and styrene, are becoming available in this country, the erection of such a plant becomes feasible.

Grangemouth's Bottled Gas Plant

The bottled gas plant at Anglo-Iranian's Grangemouth refinery is to be increased from its present capacity of 7,000 tons per year to 16,000 tons in order to cope with increased demands. This will involve the erection of four Hortonspheres for the storage of liquid butane and three storage vessels for propane, as well as the provision of a new filling shed and automatic handling and bottle filling machines. The new plant is scheduled for completion early in 1955.

New Centrifuge Announced

Sharples Centrifuges Ltd. has added to its line a new 18V machine designed to operate at liquid throughput capacities in excess of 1,000 Imperial gallons per hour.

It is particularly suited to the regeneration of insulating oil, the purification of all types of fuel oil, lubricating oil and cutting oil, and the treatment of such materials as rolling mill oil, wire drawing lubricant and other similar uses.

Personnel

The Iraq government has recently appointed a second director to the Boards of the Iraq, Basrah and Mosul petroleum companies. He is Sayid Mohammed Abdul Ghani el-Naqib, director general of oil affairs in the Iraq Ministry of Economics.

Iraq has had a representative on the company boards for the past 25 years. Since January 1947 this position has been held by H.R.H. the Emir Zeid, grand-uncle of King Faisal II, who is also Iraq's ambassador to Britain.

Sayid Mohammed el-Naqib is 42 and comes from Mosul. He studied at the American University of Beirut and at Birmingham University, where he took a degree in petroleum sciences. He was formerly government oil inspector at Kirkuk, center of the Iraq Petroleum Company's oil production.

A tribute to 58 years in the Scottish oil industry was paid to Robert Crichton to mark his retirement from the post of managing director of Scottish Oils Ltd.

Approximately 200 members of the staffs of Scottish Oils Ltd., Grangemouth Petroleum Refinery Ltd. and Anglo-Iranian (the parent company) attended the ceremony, when J. Spittal, senior works manager of Scottish Oils, presented gifts from his colleagues to Mr. Crichton. J. M. Caldwell has succeeded Mr. Crichton as managing director.

Regent Oil Co. announces the appointment of J. D. Garst as its operations director. Mr. Garst, formerly of The Texas Company and the California Texas Oil Co., New York, will be responsible for the operation of the bulk storage and transport division of Regent. Mr. Garst is 51 years old and has had a wide operational experience in the petroleum industry.

O. H. Fish has been appointed assistant general manager of the Regent Oil Co. He comes from the California Texas Oil Co., New York, is 48 and has had world-wide marketing experience in oil.

At a recent meeting of the council of the Dublin Chamber of Commerce, T. F. Laurie, chairman and managing director of Esso Petroleum Co. (Ireland) Ltd., was elected president. Mr. Laurie has had over 40 years' service with the Esso organization, having joined the company at the age of 19. He came to Dublin in 1922 to aid in formation of the Irish-American Oil Co.

C. H. Hanney, chief mechanical engineer for D. & C. and Wm. Press, has accepted an appointment with the Iraq Petroleum Co. His successor as chief mechanical and electrical engineer of D. & C. and Wm. Press is J. C. Norrey.

Ernest Riddel, chairman of William Neill & Son (St. Helens) Ltd., has resigned from the board on account of advancing years. He has been connected with the company and its predecessor for 21 years. He will be succeeded as chairman by James Harold Laithwaite, who will continue as joint managing director with H. Caddick. Tom Prescott Laithwaite has also resigned from the board and the two vacancies thus created are being filled by the appointment of John Lester Laithwaite, who has been works manager for the past 15 years, and John Laithwaite II, who has been chief engineer for eight years. Ralph Scott Evans, secretary of the company, has also been made a director.

S. M. el-Naqib

J. D. Garst

T. F. Laurie

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Los Angeles Nomads' Inaugural Ball

Five hundred and forty Nomads and guests attended the fifteenth annual inaugural ball of the Los Angeles Chapter of Nomads on February 20 in honor of the outgoing and incoming officers of the chapter. The 1954 officers, from left to right, are: Harry E. Hester of McCullough Tool Co., secretary; Earle R. Atkins of Emsco Mfg. Co., assistant secretary; Robert P. Gaylord of Wagner-Morehouse Inc., deputy sergeant-at-arms; John Flanagan of Johnston Testers Inc., president; H. J. Schlarb of Chiksan Co., vice president; J. A. Engstrand, master of ceremonies; Jas. D. Hughes of Lane-Wells Co., junior regent; O. W. Morgan, Jr., of Falcon Products Inc., sergeant-at-arms; and Leo Cypher of Baash-Ross Tool Co., treasurer. Not shown, W. A. Wilson of Web Wilson Oil Tools, Inc., senior regent; and Earl V. Tavan of Ken Corp., assistant treasurer.

Open Washington Offices

J. Edward Brantly, C. Stribling Snodgrass and Associates have announced the establishment of offices in Washington, D. C., as geologists and engineers specializing in oil and gas developments. Members of the firm are well known figures in the international petroleum industry. Mr. Brantly is the former head of the international Drilling and Exploration Co. and is author of the widely used *Rotary Drilling Handbook*. Mr. Snodgrass is a former head of the foreign division of the Petroleum Administration for Defense.

Danielson Joins Hill & Christopher

Robert E. Danielson has joined the Hill & Christopher agency, Los Angeles, for account and copy work on the Halliburton Oil Well Cementing Co. account. Mr. Danielson, former vice-president of Western Press, Inc., St. Louis, recently returned from the Far East where he served with an Army intelligence unit. He succeeds William R. Graydon, who has been appointed west coast editor of a petroleum magazine.

Refinery Propane Storage

Standard Oil Co. of Ohio is excavating underground storage of 60,000 barrels of propane at its Lima, Ohio, refinery. The storage will cost $450,000 as compared with $2 million for steel vessels of comparable capacity. Completion is planned for early 1955.

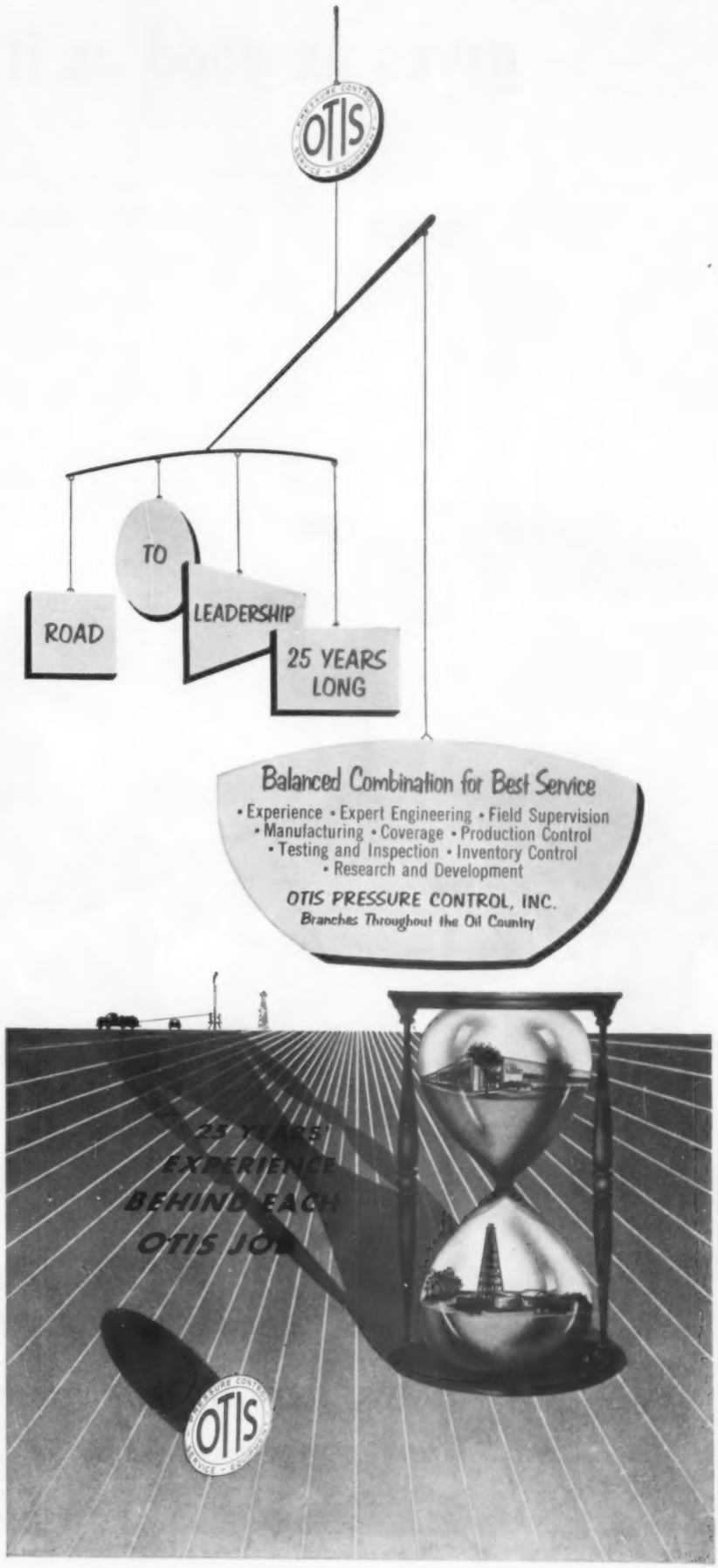
Neoprene Consumption Rises

The du Pont Company has announced that it will erect a new plant at Montague, Mich., to manufacture neoprene synthetic rubber. Consumption of the oil-resistant rubber increased 15 percent in 1953 and is rising again this year.

Book Review

Toxicity of Industrial Organic Solvents, by Ethyl Browning; second revised edition; published 1953 by Chemical Publishing Co., New York; 411 pages; $8.00.

The interest of the petroleum industry in this book will stem from the fact that it discusses at much length the toxic properties of many of the hydrocarbons and their chlorinated derivates, alcohols, ethers, esters, ketones, glycols, amines, nitro-compounds, etc., produced and handled in petrochemical plants. How to avoid poisoning by these solvents and the treatment of workers exposed to their toxic effects are extensively set forth.



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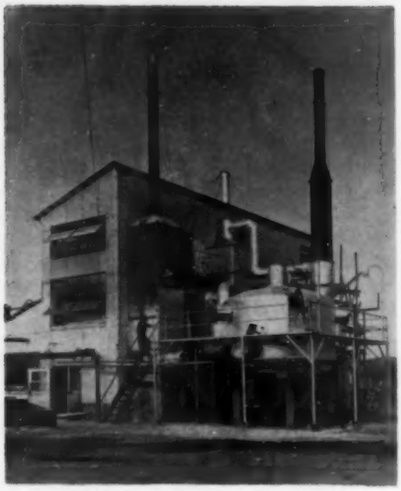


Royalite Oil Co. sulfur plant at Turner Valley, Alta.

Alberta Natural Gas

(Continued from page 101)

passes the "Golden Trend" of reefs through Wizard Lake to Homeglen and straight on to Calgary. From there it goes southeast to meet a lateral from Pincher Creek before heading almost straight east.

In the face of reserves that are exportable eastward, starting at Pincher Creek and Cessford, all of the line from Edmonton to the junction with the Pincher Creek lateral would at first glance appear to have nothing to do with export and its cost would be chargeable to Alberta consumption. The Board makes much of the need for a common carrier or common purchaser within the jurisdiction of the province that can deal with the various producers. This organization would then fill the function of distributing gas where needed within as well as outside the province. The Board further points to the probability of large additional reserves expected to be found to the west of the trunk line from Edmonton to Calgary. Such future reserves would become available for eastward movement through a line which initially would primarily serve Alberta.

In looking back at the gas flared in Turner Valley, amounting to about a trillion cubic feet, which would have been put to use had there been a trunk line to move it to Alberta markets, we must admit the desirability of the trunk line now proposed. The great obstacle to building a trunk line in the days of Turner Valley's big flares was the question of who would pay for it. Calgary consumers objected that the cost should not be charged to their rates when there was gas at their door. Edmonton consumers likewise said they had gas from Viking field and why should they pay increased rates just to use gas from Calgary's doorstep? The Board estimates average gathering costs from fields to the trunk line at 1.4 cents per Mcf and trunk line costs to the eastern gate of the province at 3.2 cents per Mcf or a total of 4.6 cents per Mcf from the well to the eastern gate. This is a very reasonable charge (if it can be attained) to make certain that future demands in any locality can be met because of interconnection. The plans of the Board and the Government of Alberta are that the trunk line will be owned and operated by a company entirely separate from Trans Canada. It must be under control of the Government of Alberta in order to provide for orderly gathering of gas with due consideration for sound conservation practice.

A bill to incorporate the Alberta Gas Trunk Line Co. was introduced into the Alberta legislature on March 19, and as we go to press, this bill has advanced to committee stage. We cannot say if changes in the bill will be made before it is passed, but in its original form, voting rights are limited to holders of 2002 Class A common shares, and the directors will be chosen from this group. Class A shares are divided into four groups and are for allotment only to persons who qualify to hold shares of a group. Group One shares are for allotment to gas utility companies; Group Two to gas export companies; Group Three to gas producers and processors; and Group Four is reserved for allotment to the board of directors.

Eight million Class B common shares of par value of $5.00 each will be sold.

While the Trunk Line Co. may act as a common purchaser, it is the hope that in most transactions it will act as a common carrier. As a common carrier it would not be concerned with contracts between the export company (Trans Canada Pipe Lines) and producers of gas. Such contracts would be made between the principals, and Trunk Line would accept, transmit and deliver the gas to a gate at the eastern boundary of Alberta.

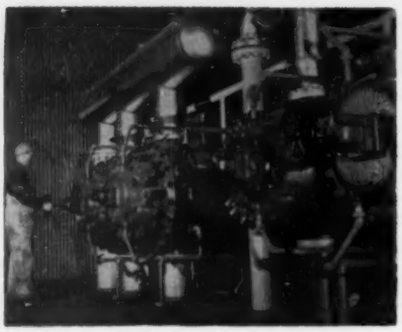
Allowable production would be allocated

(Continued on next page)

ANALYSES OF ALBERTA NATURAL GAS
(Petroleum and Natural Gas Conservation Board, May 1, 1953)

Field or Area	Zone	H_2S	CO_2	N	C_1	C_2	C_3	C_4	C_5	Gross Heating Value Btu/scf.	C_3+ gpm Gal/ Mscf.
Acheson	Viking	0	0	*	*96.1	2.3	1.0	0.4	0.2	1,036	0.38
	L. C.	0.4	1.4	6.7	80.0	6.2	3.2	1.1	1.0	1,084	1.31
	Leduc-D-3	Nil	0.8	*	*48.0	18.1	19.8	9.7	3.6	1,880	8.06
	Leduc-D3	0	0.5	5.3	62.4	16.0	11.2	3.6	1.0	1,360	3.79
Belloy	Gething	0	0.4	*	97.7	1.7	0.2**	0	0	999	0.40
	Miss.	0	0	*	91.4	4.5	2.2	1.1	0.8	1,095	1.00
	Permo Penn	0	1.0	*	90.9	4.3	2.0	1.1	0.7	1,086	0.98
	Nisku	0	0.3	2.3	96.0	1.4	Trace	Trace	0	997	0.11
Cessford	Bow Island	0	1.4	1.7	87.8	5.4	2.3	0.9	0.5	1,096	0.90
	Basal Col.	0	0.2	3.7	91.2	2.7	1.2	0.5	0.5	1,041	0.55
	Sunburst	0	0.9	3.2	88.6	4.5	1.6	0.8	0.4	1,037	0.68
Fort Sask.	Viking	0	0.1	5.8	91.3	1.7	0.6	0.3	0.2	985	0.26
Golden Spike	D-3	0	1.0	4.8	57.7	17.5	13.4	4.5	1.1	1,431	4.518
Jumping Pound	Rundle	4.4	5.2	0	84.8	3.9	0.7	0.6	0.4	961	0.44
Leduc-Woodbend	Viking	Nil	0.3	3.6	87.9	4.6	2.5	1.0	0	1,049	0.81
	Blair	1.0	2.6	3.4	66.3	15.4	7.7	2.8	0.8	1,136	2.69
	Nisku D-2	0	0.3	2.8	68.2	17.6	7.9	2.5	0.7	1,269	1.63
	Virgin D-3 Gas	0	0	1.5	82.4	11.6	4.5	0	0	1,132	1.01
	Leduc D-3	0	0.4	1.6	65.0	18.3	10.3	2.5	0.9	1,369	3.23
Medicine Hat	Med. Hat Ss	0	0.3	3.8	95.6	0.2	0.1	Trace	0	975	0.02
Morinville	Basal Blair	Trace	1.9	4.1	85.4	5.3	2.1	0.7	0.5	1,058	0.82
Oberlin (Erskine)	Lr. Cret.	0	0.5	3.7	87.2	4.3	2.3	1.3	0.8	1,093	1.09
Pendant D'Oreille	Bow Is.	0	Trace	9.5	90.0	0.3	0.2	0	0	1,919	0.56
Pincher Creek	Rundle	8.5	6.6	2.7	74.1	5.5	1.3	0.7	0.5	1,064	0.62
	Rundle	7.9	6.5	2.1	76.7	4.5	1.6	0.6	0	1,050	0.52
Pouce Coupe	Gates Ss	0	0.3	2.3	94.6	2.7	0.1	0	0	1,007	0.02
Princess	Bow Island	0	0	3.3	94.0	1.6	0.7	0.3	0.1	1,010	0.27
	Basal Col.	0	0.2	4.7	89.9	3.1	1.2	0.7	0.2	992.5	0.51
	Sunburst	0	2.2	3.7	87.1	3.5	1.3	1.5	0.7	1,052	1.08
	Madison	0	0.4	4.1	88.4	3.6	2.1	0.9	0.5	1,047	0.84
	Jefferson	0	0	13.0	74.5	7.5	3.2	0.4	0.9	1,029	1.20
Provost	Viking	0	0	4.0	91.4	2.0	1.5	0.7	0.4	1,062	0.72
	Lr. Cret.	0	0.1	0	94.7	2.5	1.4	0.9	0.4	1,061	0.68
	Lr. Cret.	0	0	3.1	92.5	2.1	1.2	0.7	0.4	1,021	0.56
Redwater	Viking	0	0	2.7	92.4	3.1	1.2	0.4	0.2	1,032	0.435
	Lr. Cret.	0	0	2.7	92.3	3.5	0.9	0.6	0	1,017	0.362
	Leduc D-3	3.9	0.6	2.1	53.3	18.6	14.1	5.3	2.1	1,451	5.157
Stettler	Nisku D-2	3.30	0.3	10.9	53.1	14.0	13.3	4.2	0.9	1,269	4.35
	Leduc D-3	2.9	8.7	15.3	42.7	11.9	12.4	4.8	1.3	1,144	4.43
Sturgeon	Basal Ss.	0	2.1	4.1	82.2	6.7	3.0	1.2	0.7	1,065	1.07
Turner Valley	Rundle	1.4	2.2	0	81.5	7.6	4.3	2.2	0.8	1,149	1.80
Viking Kinsella	Viking	0	0	4.7	92.4	2.2	0.6	0.1	0	969	0.16
Whitelaw	Gething	0	0.4	1.0	97.3	0.4	0.3	0	0	978	0.06
	Permo Penn	Nil	0	5.3	85.8	3.7	2.5	1.4	1.3	1,075	1.33
Wizard Lake	D-3	1.0	0.9	1.5	61.0	17.1	11.4	5.2	1.9	1,424	4.47

*Nitrogen & methane components not separated by analysis.
**C_4+



Compressors in Leduc gas conservation plant of Imperial Oil Ltd.

Alberta Natural Gas

(Continued from page 175)

by the Alberta Petroleum and Natural Gas Conservation Board in much the same way that oil allowables are fixed.

When we touched earlier on Pincher Creek and Okotoks, we suggested that these two fields could fix sulfur at the rate of around 1,500 tons a day. From incomplete analytical data, we suggest that by 1962 Nevis will be yielding 130 tons daily. At the present time the Shell plant at Jumping Pound is fixing about 30 tons a day and that plant is being enlarged to permit of greater gas delivery to Canadian Western. Royalite's plant in Turner Valley is turning out another 30 tons a day. Even if no other large plants become needed when gas export is a reality, it looks as if around 1,800 or more tons of sulfur could be fixed every day in the year for, say, 20 years. Not all of this will develop at once, but probably soon enough.

What is to be done with the sulfur?

At the present rate of 60 tons a day and so long as existing contracts run, there is no problem. While there was a shortage of sulfur from the Gulf Coast, Shell contracted its output to paper mills on the Pacific Coast, and ships its output to Vancouver by Canadian Pacific Railway for barging to paper mills. The freight rate is $14.00 per short ton and nets the company $20.00 f.o.b. Cochrane. Recent developments in the Gulf Coast indicate that this Alberta sulfur is not competitive with Texas sulfur at Vancouver and the price may need revision when contracts end.

Concurrently with the threat of immense stock piles of sulfur, we observe that Consolidated Mining and Smelting has just recently put a fertilizer plant into operation at Kimberley, B. C. It uses iron pyrites accumulated in a dump near the concentrator to supply its sulfur. Ammonia from their Calgary plant produced from natural gas is reacted with sulfuric acid derived from the sulfur. The lesson of unwanted sulfur in the form of sulfur dioxide at Trail, B. C. being turned into fertilizer which is marketed all over the world will no doubt be kept in mind by Alberta producers of sulfur as a by-product of natural gas. We cannot suggest that Alberta sulfur will be shipped to paper mills in Ontario by an all-rail route, but the railways will, no doubt, be happy to get extra tonnage to tidewater and will make rate concessions on bulk commodity material in keeping with its intrinsic value.

The expected yield of sulfur will be roughly of the same order as or up to double the total Canadian demand, but inhabited Canada is a fairly narrow country from north to south and very wide from east to west, so transportation becomes a problem. So long as uranium is high in price, sulfur will find a place in its concentration. Low grade ore can be leached with sulfuric acid which dissolves uranium oxide preferentially. Doubtless other uses will be found for sulfur that did not exist previously, but we expect stock piles will accumulate for a time before demand entirely overtakes supply.

We mentioned earlier that Pincher Creek could extract some 12,000 barrels daily of light ends ranging from propane to heptane. Of this, about 7,500 barrels per day will have a high enough boiling point to permit blending into motor gasoline in summer. Another 800 barrels per day (isopentane) will go into winter gasoline and some of the 1,600 barrels a day of butanes might also be used in winter gasoline. The proportion of butanes suitable for use even in winter gasoline will be limited and this one field will need to look for outlets for a sizeable quantity of LPGas.

Okotoks will have moderate amounts of light ends and we forecast that very large quantities of light ends must be expected when the Homeglen composite of fields starts delivering into the line to Calgary. A recent study that took account of natural gasoline plants existing and under construction plus Pincher Creek, but not including Homeglen, forecast some 7,000 barrels a day of natural gasoline and LPGas and concluded that there will be adequate market outlets for natural gasoline although refiners' specifications will call for low vapor pressure in summer. The market area for LPGas will include the four western provinces plus Montana, Idaho and Washington. Over-production of propane and butane is expected. The surplus needs study by the industry and might be reduced by development of economic pipe line transportation to eastern Canada. Expansion of the petrochemical industry may assist in reducing the surplus. Consideration can be given to putting surplus products into crude oil or gas reservoirs.

The writer cannot picture light ends being transported by truck, say, from Pincher Creek to Edmonton in order to put the product into a pipe line leading to Sarnia and there are some questions yet to be studied as to the effect of introducing light ends into a crude oil pipe line, particularly when the transcontinental pipe line will be delivering crude oil to several refineries on the way which do not require, let us say, butane. It is possible that the free ride for an unwanted product will have some compensation by the reduced viscosity and reduced pumping costs, but this suggestion is still a matter of study and we can go no further with it at this time.

It is of interest to note the recently completed Canadian Chemical Co. plant at Edmonton which oxidizes butane and mixtures of propane and butane to produce acetic acid and related chemicals. There is, however, a limit to the outlet of such chemicals so far from points of consumption.

There is a chance that propane might be left in the gas being piped eastward, at least in moderate proportions. In the early years of operation, it is expected that the line capacity will not be fully used and should propane liquefy in the line, the situation would not be too critical. As the capacity becomes more nearly saturated, it may become necessary to extract more of the propane, if not all. Another item for consideration is that large proportions of propane in the delivered gas would put the Btu content high enough to demand either general adjustment of consumers' appliances or dilution with air until the Btu content is reduced to, say, 1,000 Btu cf. This latter device is actually in action at Edmonton during periods when most of the supply comes from Leduc casinghead gas. It is something of a nuisance owing to oxidation of pipe and fittings, but it avoids constant adjustment of consumers' appliances.

In general, we can forecast that before any lateral lines enter the trunk line, the gas will have to be dehydrated. Just where, and by what process, will be governed by local circumstances.

We expect that butane and heavier hydrocarbons will require removal, and ultimately at least a part of the propane must be removed. This suggests absorption plants for fields such as Homeglen and Cessford. Where casinghead gas is gathered from oil wells, compression will be required to put the gas into the trunk line and it is expected that the heavier hydrocarbons will be knocked out during compression rather than by absorption.

Sulfur in the form of hydrogen sulfide and mercaptans will need to be brought to elemental form and only traces of sulfur left in gas delivered to the line. Carbon dioxide will probably be removed at the same time as sulfur compounds. This involves a major sulfur plant at Pincher Creek and one at Okotoks. When Nevis and Olds start delivering gas, plants will also be required there, and it is possible some others will also be needed.

The study of just how many plants of various kinds will be required and their capacity must involve greater attention than we can give to the matter in this paper.

Reference Book on Canadian Oil

The 1954 edition of the annual survey of the Canadian oil industry published by The Financial Post of Toronto made its appearance in April. Over the past several years this work has become a standard reference for investors and others interested in the oil industry in Canada.

The current volume records an increase of 50 percent in Canadian oil reserves to three billion barrels or more as a result of the opening of the Pembina field, rated now as the largest in the Dominion, and of numerous other discoveries in the western provinces. A rise of 350,000 barrels in the daily production capacity is estimated. An upturn in drilling activity and the expansion of transport facilities are factors in extending markets and maintaining the growth of production.

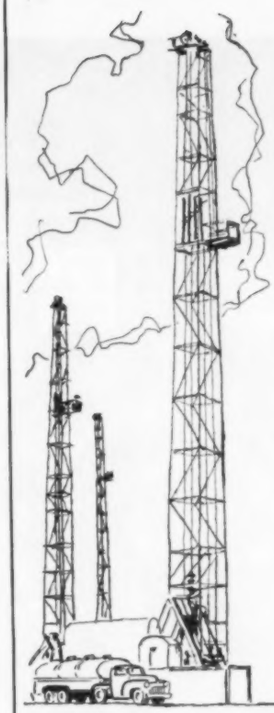
The survey contains a list of over 600 western oil companies with data as to their holdings, production, reserves and earnings. It also contains a five-year table of oil stock movements and a large amount of other statistical material.

Survey of Oils, 1954; 364 pages; Maclean Hunter Publishing Co. Ltd., Toronto, Canada. Price $3.00.

Oxy-Catalyst for Diesel Exhaust

A catalytic muffler that effectively reduces the noxious and irritating components of 4-cycle diesel engine exhausts has been developed by Oxy-Catalyst, Inc., Wayne, Pa. The new device, called the Dieseler, attaches directly to the engine exhaust manifold and burns the noxious carbon monoxide and odorous hydrocarbon fumes in exhaust gases by catalytic action.

This catalytic process eliminates much of the heavy smoke and strong odor for which diesel trucks and buses are noted, and in industries such as mining, will permit more widespread use of 4-cycle diesel equipment underground or in enclosed plant areas.



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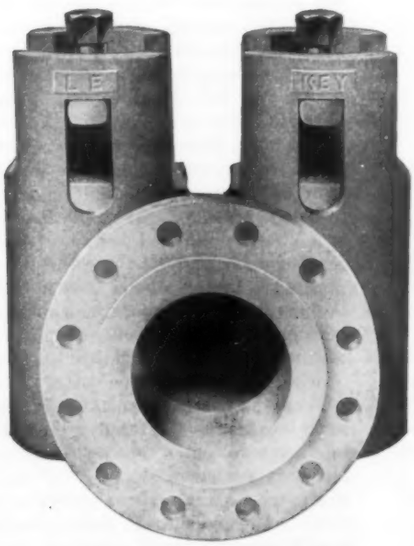

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Operator at Interprovincial Pipe Line Co. pump station at Cromer, Man., control panel regulates flow of crude and detects any irregularities. Imperial Oil Ltd. Photo.

Manitoba production increases rapidly

By Leslie Orr Rowland
Editor, Oil in Canada

MANITOBA, scene of the first crude oil discovery in the Williston Basin early in 1951, has soared to prominence in the past year as a hot search region for light oil and has become a significant producing area. Its Mississippian limestone production reached almost 4,000 barrels per day in January and is growing. Well completions rose to three or four wells a week last winter and there were 15 rotary rigs busy in the province at the beginning of spring.

Manitoba's sedimentary area is very small compared to the vast square mileage of potentially oil-bearing rocks lying beneath the surface of Saskatchewan and Alberta. The portion of the province underlain by rocks of Mississippian and earlier age amounts to only about 2,700,000 acres, and the total area underlain by sedimentary rocks of any age is no more than 76,800 square miles, or less than eight percent of the entire Prairie sedimentary basin. It is generally considered, as a result of geological studies extending over a period of at least 50 years, that only the Mississippian sediments offer a good prospect for oil discovery. Of more than 200 wells, both wildcat and development, drilled since the intensive search for oil began in 1949, only a dozen or so have been completed outside the Mississippian boundary.

Considering the area of Mississippian formation—4,200 square miles—in relation to the vastly greater 250,000 square miles in Saskatchewan, the growth of Manitoba production has been phenomenal. From 1,000 barrels per day in December 1952 it leaped to 3,679 b/d in December 1953, a figure not attained as a year 'round average in Saskatchewan until 1951. Developments in the first quarter of 1954 point to a probable 10,000 b/d production before the end of the year, slightly more than the highest point attained in Saskatchewan as recently as the end of 1953.

Total production this year should be comfortably over 2,000,000 barrels, three times the 1953 total of 656,181 barrels. This production can be attained by development of known pools, without making any allowance for further discoveries which may be made in the course of wildcat drilling, and without considering formations other than the Mississippian.

Historically, the discovery of oil in the Mississippian was the result of a conversion in thinking from the "reefology" of Alberta experience to an appreciation of the fact that the eastern Prairies do not contain reef type oil accumulations. The objective of the first three or four wells drilled in southwestern Manitoba in the summer of 1949 was the Devonian formation, in the hope of finding a reef structure similar to those producing prolific quantities of light oil in Alberta. Despite the preliminary exploration work of three seismograph parties over an average period of three years (or some 100 crew months) in the southwestern corner of the province, it is now possible to say with a considerable degree of accuracy that the seismograph is not capable of indicating specifically the potential oil-bearing structures in this sedimentary area. The second of the two major pools to be discovered, at Roselea last summer, was based on nothing more scientific than the presence of a temporarily idle drilling rig in the vicinity of the farm of close relatives of the rig owner.

Seismograph activity at present has dropped to zero in Manitoba. It seems likely that future wildcatting will consist of "fill-in" drilling between regions of known oil accumulation, while the delimiting of pool boundaries will be done only by complete drill-out of all offset wells.

A study of the sedimentary section in Manitoba does not give much help in planning a search for oil, but it is interesting to find the complexity of a much larger region in this relatively microscopic portion of the now famous Williston Basin, of which it constitutes the northeast flank.

From the Precambrian shield of igneous rocks, which flows laterally across Manitoba from a point on the international boundary a few miles east of the Red River to a point on the Saskatchewan-Manitoba boundary near Lake Athapapaskow a short distance south of Latitude 55, a series of Palaeozoic and Mesozoic strata dip gently westward and southward into the Basin. Six formations are present in the thickest sedimentary section. With their maximum thicknesses, and in order of age from oldest to youngest, they are: Ordovician, 900 feet; Silurian, 200 feet; Devonian, 1,900 feet; Mississippian, 1,000 feet; Jurassic, 1,200 feet; and Cretaceous, 2,300 feet.

The Mesozoic beds, which are exposed

in outcrop in most of the region, have a regional dip of seven to ten feet per mile, resting on the eroded surface of underlying Palaeozoic beds which show a regional dip of 30 feet per mile. The successive truncation of formations against this unconformity introduces successively younger Palaeozoic beds under it to the southwest. The Mississippian and most of the Devonian have been truncated before they reach the surface, and the outcrops of Devonian in the Lake Winnipeg and Lake Winnipegosis area, where some reef structures have been observed, appear to have no relation to any potential oil-bearing structures elsewhere. Only the lower third of the Devonian section appears in these outcrops.

The non-oil-bearing formations of Manitoba will be summarized very briefly:

The Ordovician strata, found in three formations (Winnipeg, Red River and Stony Mountain), include shales, partly fossiliferous; thin sandstones; limestones and dolomites, mostly of low porosity.

The Silurian, of which the basal member is exposed in the stone quarry at Stonewall, near Winnipeg, is a single unit in the subsurface, consisting mostly of dolomites with scattered sand grain horizons, all of poor porosity.

The Devonian section, thickest in the area, comprises four units which are made up of shaly limestones and dolomites, shales running to considerable thickness, and anhydrites. There is some fairly good porosity in the limestones and dolomites.

The Jurassic consists of two dissimilar units, the lower unit a thin limestone underlain by anhydrite, shale and red beds, the upper unit mainly clastics. In the Daly oil field and the area to the north, lenticular sands of over 100 feet thickness have been encountered, saturated with salt water, while other sands bearing fresh water have been found to the south and west, up to 120 feet thickness. The Jurassic oil discovered at Wapella, Saskatchewan, a few miles across the provincial boundary, has not so far been duplicated in Manitoba.

The Cretaceous formation, well exposed through most of its section at various places, has been correlated in its four units and six sub-units with sands in Alberta and the northern states. Water-bearing sands have been found, and several shale units are contained in the formation.

The Mississippian formation, confined to the extreme southwest corner of Manitoba, is the source of oil in the two major pools at Daly and Roselea in the Virden area, two minor pools at Tilston and Whitewater Lake in the southerly part of the province close to the international boundary, one isolated small discovery well southwest of the two minor pools, two discovery wells in the Virden and Linklater areas which were abandoned after producing negligible quantities of oil, and three discovery wells (one near Virden and the others in the southeast part of Mississippian region) suspended after producing small quantities of oil.

Although it has been found a prolific producing formation in the Roselea oil field and its four closely-related extension discovery wells have been completed since the major discovery last summer, it has been rather disappointing as a source of oil in the few discovery areas farther south, west and east. The total thickness in the Virden-Roselea-Daly region, however, is not more than one third of the thickest section found in some of the hundred significant wildcat wells drilled in Manitoba up to the middle of March.

Since the Mississippian formation is the only one so far found productive of oil, a fairly definite approach to wildcat drilling in Manitoba has been developed out of experience. To understand this approach, a summary of the Mississippian stratigraphy and lithology is helpful.

The Mississippian, confined to the small area in the southwest referred to, in general has a thickness of less than 400 feet. At Daly it is approximately 300 to 340 feet thick, at Linklater a few miles west its thickness is 380 feet, and it thickens rapidly to a maximum section of 900 feet at the Souris Valley wells in the vicinity of Coulter, and to 800 feet at Waskada ten miles to the east.

The fact that the productive area of Manitoba is really part of the northeast fringe of the Williston Basin is generally appreciated by operators in the Dakotas and Montana, and some of the terminology applied to stratigraphic sequences is derived from those regions. Firm correlations are very difficult to determine with the comparatively slight extent of drilling in Manitoba up to the present, and particularly with the small number of wells which have penetrated into the deeper horizons. Recently, however, with the object of introducing a standard nomenclature for the entire Williston Basin area, a meeting of geologists who are all members of the A.A.P.G. from Montana, North Dakota, Saskatchewan and Manitoba revised certain classifications in the Devonian and Jurassic, and devised a new name for the basal unit of the Mississippian, which is now to be called the Bakkan formation.

The best analysis of the Mississippian is contained in a paper presented at the annual western meeting of the Canadian Institute of Mining and Metal-

Stratigraphic Section — Southwest Manitoba

J R OWER, MARCH, 1954

Age	Unit	Equivalent		Sub Unit	Average Thickness	Gross Lithology
CRETACEOUS 2300' MAX.	A	RIDING MOUNTAIN or PIERRE		A	900-1000	Grey Shale
	B	BOYNE or NIOBRARA		B-1	70	Speckled Calcareous Shale
		MORDEN or CARLISLE		B-2	230	Grey and Black Shale
	C	FAVEL or GREENHORN		C	110	Speckled Calcareous Shale
	D	ASHVILLE or GRANEROS		D-1	140	Grey and Dark Shale
				D-2	200-250	Shale, Lenses Coarse Quartz Sand
JURASSIC 400'-1200'	A	(PROBABLE MORRISON or CRETACEOUS) SUNDANCE		A-1	200	Sandy Shales, Sand and Limy Sand
				A-2	400	Shale; Lime and Sand at Base
	B	GYPSUM SPRINGS or AMARANTH		B-1	0-20	Limestone; Minor Chert and Anhydrite
				B-2	0-150	Anhydrite
				B-3	0-120	Red Shale and Siltstone
MISSISSIPPIAN 0-1000'	A	MADISON (SOME MISSION CANYON) MAINLY LODGEPOLE		A-1	100	Dolomite, Bands of Anhydrite
				A-2	50-100	Limestone, often Porous or Crinoidal
				A-3	100-200	Shaly Limestone, Chert
	B	BAKKAN		0B-1	-10	Black Shale
				B-2	0-20	Sand and Silt
DEVONIAN 1900' MAX.	A	LYLETON/THREE FORKS		A	100	Red Beds
	B	JEFFERSON (UPPER PART) NISKU+DUPEROW		B-1	100	Dolomite, some Anhydrite
				B-2	300	Limestone, Dolomite, some Anhydrite
				B-3	170	Porous Dolomite
	C	JEFFERSON (L.P.) or MANITOBA	SOURIS RIVER	C-1	300	Limestone, Shale and Anhydrite
			DAWSON BAY	C-2	220	Limestone, partly Organic
	D	ELK POINT	PRAIRIE	D-1	400	Salt and Anhydrite, Red Shale
			WINNIPEGOSIS	D-2	40-100	Dolomite, partly Organic
			ASHERN	D-3	30	Red Beds
SILURIAN 300'	A	INTERLAKE		A	300	White Dolomite, Sand at Base
ORDOVICIAN 900'	A	STONY MOUNTAIN	GUNTON	A-1	120	Pale Dolomite
			ST. MTN. SHALE	A-2	80	Shale and Shaly Limestone
	B	RED RIVER		B	450-500	Limestone and Dolomite
	C	WINNIPEG		C	100-200	Green Shale, Sand at Base
PRE CAMBRIAN						Igneous and Metamorphic Rocks

lurgy in Winnipeg in October 1952 by John R. Ower, division exploration superintendent of the California-Standard Company. Mr. Ower received the Barlow Memorial Medal of the Institute at its recent meeting in Montreal for this paper, which was adjudged the best contribution to geological research for that year. The interpretation which follows is largely based on this paper.

The Mississippian in Manitoba can be subdivided into two units, a lower very thin clastic unit and an upper carbonate unit. Unit B, the Basal Kinderhook member, now renamed the Bakkan formation, is composed of a few feet of grey to black shale at the base of the Mississippian, underlain by as much as 20 feet of fine silt, sand and limy silt. The black shale is highly radioactive and makes an excellent marker on gamma-ray logs. The silt is absent in the Daly oil field but is present in the Ewart well ten miles south, which is accepted as the type well for the region down to the top of the Silurian. It is also present in wells to the south of Ewart. The shale, but not the sand, is present in the Imperial Madeline well a considerable distance to the north, which was a basement test, and in the California-Standard Wawanesa 3-1 well, an anomalous well which found the formation a longer distance farther east than its indicated general line of truncation.

South of Daly, in both the Ewart and the Linklater well, the silt was cored and found to be saturated with light oil, but it was tight and unproductive.

The upper and thickest part of the Mississippian, Unit A, generally termed Madison as a group name, appears in the Daly area to be largely the equivalent of the Lodgepole of the Dakotas or the Banff shale of Alberta. In the Daly field it is possible to divide this unit into three sub-units, but the subdivision is of only local significance.

The lowest sub-unit, termed A-3, is the "shaly zone" composed of 100 to 200 feet of shaly limestone, often mottled greyish-green and purple to red. Tripolitized chert nodules occur commonly, especially near the base. A very localized organic and porous zone has been observed in a few wells where it contained water with live oil shows.

The A-2 middle member is the producing section at Daly. Termed the crinoidal zone, it is 50 to 100 feet thick, averaging 65 feet in all Daly wells completed up to the end of 1953, and consists of alternating crinoidal, siliceous and shaly limestones with partings of red shale. Irregular and thin bedding is observed. The lithology varies from well to well, with porosity apparently related to the amount of crinoidal limestone. Immediately northeast of the field, where the Standard of California 16-20 dry hole was drilled, it tends to be replaced by red and maroon shale or shaly limestone.

The upper zone, termed the A-1, is microcrystalline or anhydritic, 70 to 100 feet thick, consisting of microcrystalline dolomite with numerous bands and lenses of bluish-white crystalline anhydrite. Thin bands and nodules of chert are common, usually tripolitized. This zone lacks porosity and is not believed to contribute to production.

As the Mississippian section thickens toward the southwestern corner of the province, the distinction between the three members diminishes and at the Souris Valley wells they are indistinguishable. At the opposite end of the Mississippian area toward its northern limit it is shaly to a large extent, and again the members are not recognizable.

Massive anhydrite beds at the extreme top of the section in the southwest corner, to a thickness of 20 feet, have been tentatively correlated with the base of the Charles formation, a proven source of production in eastern Saskatchewan. Oil production in the Roselea pool comes from the fragmental and oolitic limestones which in that area appear as four or five rather stringy members with tight zones between.

From the beginning of oil drilling in Manitoba up to the middle of March 1954, 112 wildcat wells had been completed and all but two had been finally disposed of. Discounting the shallow tests which had no stratigraphic significance, 100 wildcats had penetrated enough of the sedimentary section in thick enough areas to be of value for specific and comparative information. Of this substantial group, only 11 have penetrated the entire section to the Precambrian (igneous) basement, three have reached the Ordovician, 12 have been completed in the Silurian and five have reached the base of the Devonian. The other 69 have all been completed in the Mississippian or various distances into the Devonian.

In the past 15 months, only one basement test has been drilled, while four wildcats have been taken to the Silurian. A Mississippian wildcat costs approximately $35,000, while a test to the Devonian base or into the Silurian will cost $60,000 to $65,000 and a basement well up to $100,000.

The current practice is generally to drill Mississippian tests and to stop in that formation if the well is productive, but in the case of dry holes the well is commonly carried to the Mississippian base in order to add to the backlog of structural and stratigraphic information about this formation. As a result of the information gained in the sinking of some 350,000 feet of hole on wildcats, the line of truncation of the Mississippian has been defined with a general degree of accuracy, cutting across the region from northwest to southeast and enclosing all the discovery wells by a margin of at least 20 miles.

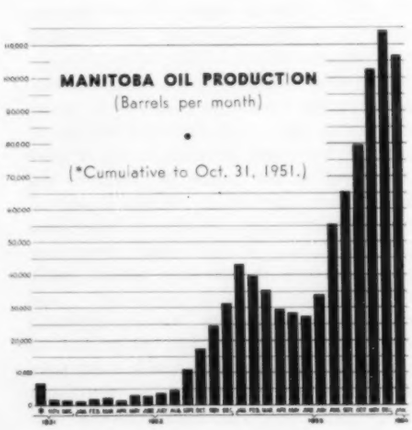
The justification for this attention almost exclusively to the Mississippian appears to be the phenomenal discovery rate of the past nine months. Since the beginning of July 1953, out of 26 wildcat completions, eight oil discovery wells have been completed and placed on production and two more indicated discoveries are in the course of being tested. Arising out of those discoveries, up to the middle of March, 34 development wells had been completed. During the first two and one half months of 1954 another 20 wells were completed in fields discovered earlier.

At the middle of March wells capable of producing in Manitoba numbered 140. The Daly field, first discovered, had 97 oil wells, of which four were being used temporarily as water injection wells in the southeast corner of the field, in an experiment on the possibility of increasing flow rates by this means. The Roselea field, first to yield a substantial number of flowing wells with large initial potentials, had 35 producers. Whitewater, a 1953 discovery, and Tilston, a discovery of 1952, had three wells each, and single wells were producing at Coulter, Pierson and West Daly. Two discoveries of 1952, at Waskada and Lulu Lake, in the extreme southern part of the province near the point of truncation of the Mississippian, were suspended as noncommercial early in 1953 after producing respectively 4,007 and 1,484 barrels.

In January, the latest month of official production record, the bulk of output came from wells owned by two subsidiaries of California companies. The California-Standard Company, which had the distinction of making the initial discovery at its Cal-Standard Daly 15-18 wildcat (1sd 15-18-10-27WPM) in January 1951, produced 30,368 barrels from 35 wells. Canadian Superior Oil of California Ltd., with only 21 wells, took top place in gross production of 35,814 barrels. These figures were 30 and 35 percent, respectively, of the provincial total of 106,801 barrels. Cumulative production to that date amounted to 881,947 barrels. The number of wells actually producing in January was 99.

The rapid growth of drilling activity in the past three years is obvious from comparative figures of wells which completed

(Continued on page 182)



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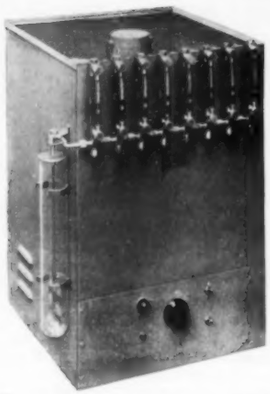

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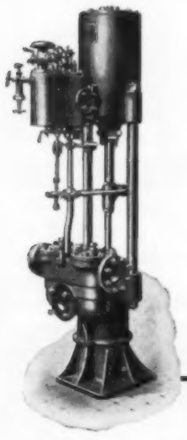

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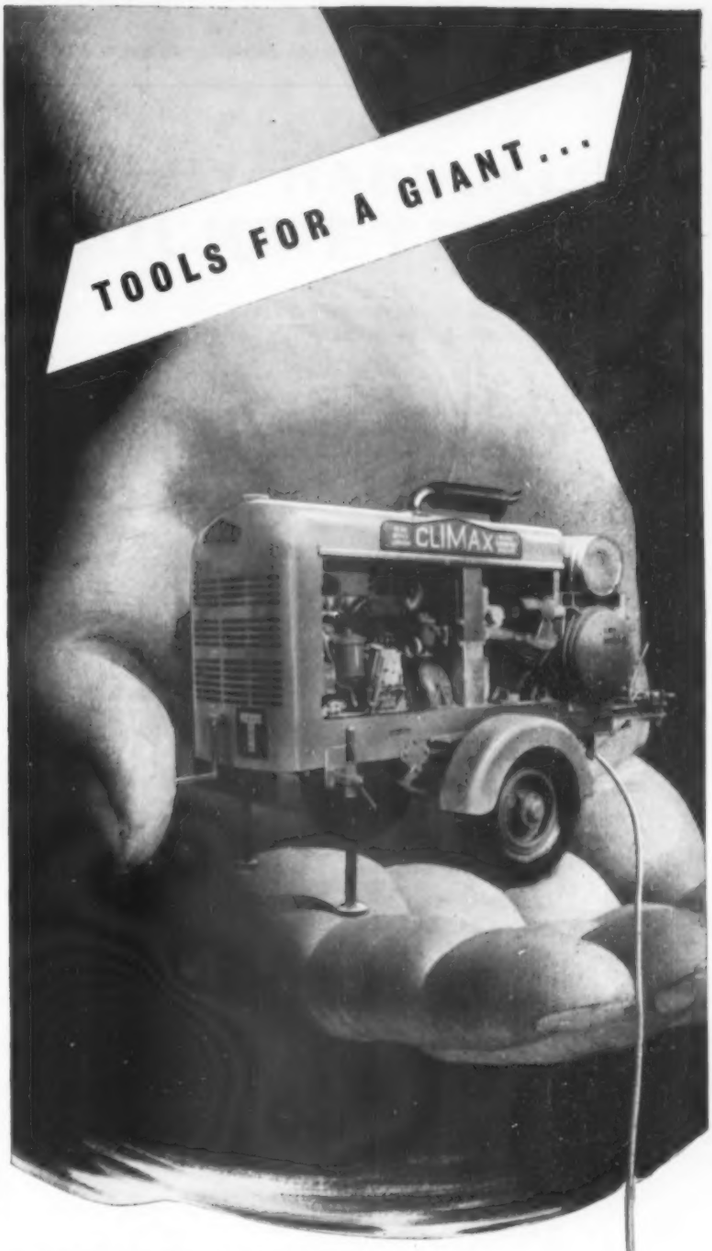

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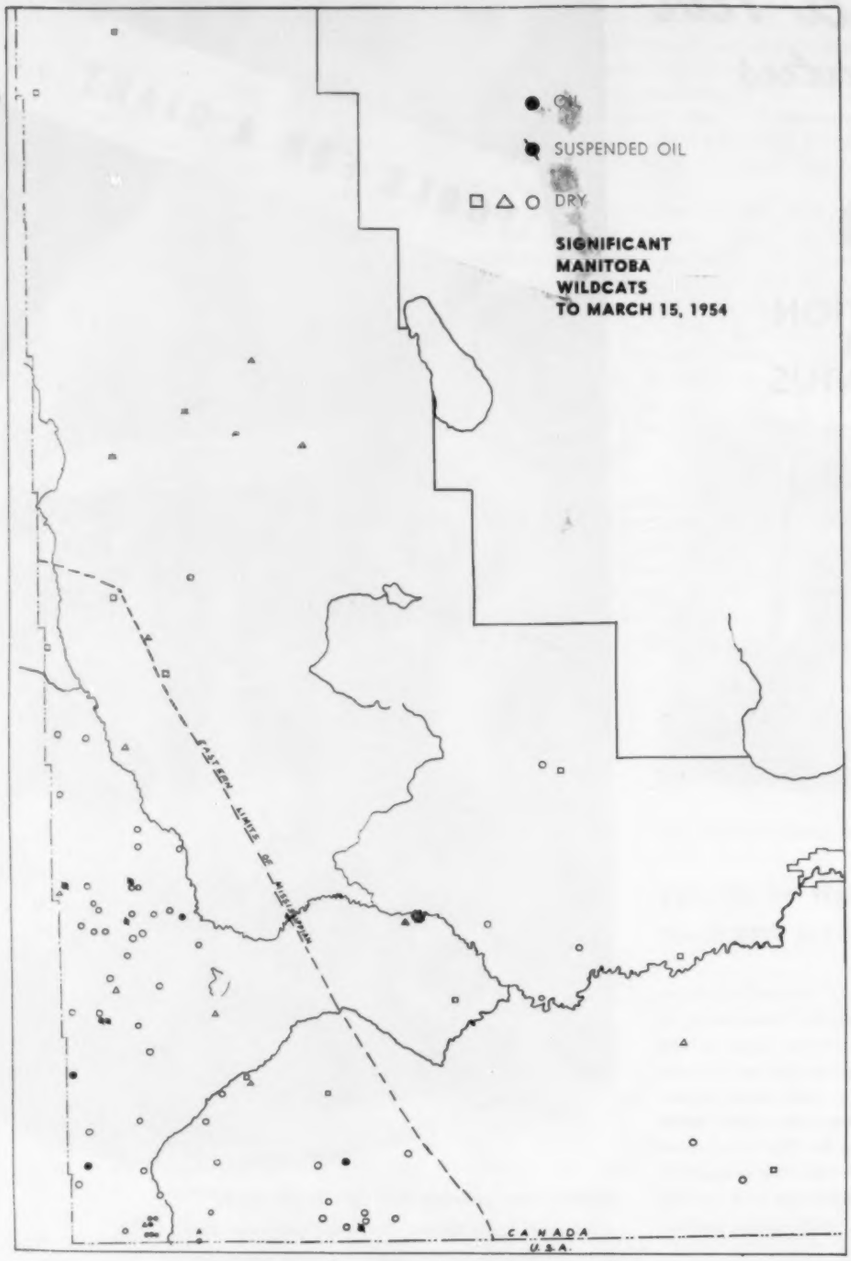

Manitoba Production

(Continued from page 180)

drilling in each calendar year. In 1951, 12 wildcats and four development wells were completed; in 1952, 40 wildcats and 31 development wells; in 1953, 28 wildcats and 67 development wells. In the first two months of 1954 the total was 11 wildcats and 30 development wells. The operators expect to complete between 150 and 200 wells this year, on the basis of offset commitments and prospective wildcatting, although it is considered doubtful whether the number of wildcats will exceed those drilled in the banner year of 1952.

In 1954, for the first time, allowable rates of production were established by the provincial Oil and Natural Gas Conservation Board. The current rates in March were 100 barrels per day for Roselea and 120 barrels per day for Daly. The wellhead price for Daly crude was posted by Imperial Oil Limited, principal purchaser, in January, at $2.70 per barrel of approximately 34 to 35° API gravity, f.o.b. gathering system which delivers to the Interprovincial Pipe Line Company's pumping station on its main line at Cromer, six miles from the field.

Although Manitoba refining capacity amounts to nearly 20,000 b/d, Manitoba crude is not being purchased for the exclusive use of local refineries but is mostly being merged with Alberta crude in the pipe line and finding its ultimate destination at Sarnia, Ontario. On balance, however, it is indicated that Manitoba crude will be bought by the major refiners either within or outside the province up to the point at which production meets provincial refining capacity. This intimation was given in December, at a press conference in Winnipeg, by W. D. C. Mackenzie, western producing department manager of Imperial Oil Limited. The statement of policy has important implications for the potential expansion of Manitoba production, which so far has managed to keep very close to producibility, a situation not found in any other region of western Canada under present economic marketing conditions.

Reservoir studies made by the operators' committees for both major pools were released at the provincial hearing on maximum permissive rates of production held early in February. The principal factors are summarized below:

DALY POOL

Average net pay	63 ft.
Development factor	2.5
Acreage factor	1.0
Porosity (wt. aver.)	10.7%
Connate water	40%
Recovery life factor	.90
Calculated MPR	153 b/d

VIRDEN-ROSELEA POOL

Average net pay	35 ft.
Development factor	2.5
Acreage factor	1.0
Porosity	10.15%
Connate water	30%
Recovery factor	25%
Recovery life factor	1.25
Life of pool	10 years
Calculated MPR	131 b/d

John Zedde, of the California-Standard Company, who presented the submission, explained that data available thus far are not extensive, and it is apparent that no reliable guide has been found for delimiting field boundaries other than by drilling out all available locations. If the water flood experiment is successful, he said, the limits of a field are likely to be even more difficult to ascertain, as submarginal producers might become economic by application of this treatment. His core analysis of 18 wells was the basis for the average net pay thickness figure. Drilling results, he said, cannot be correlated with any seismic or geological data available, so that the performance of any prospective well cannot be forecast by the fact that it does not offset a producer or a dry hole.

Proof of the accuracy of these conclusions was presented during the latter part of March with the completion of two dry holes offsetting fairly good producing wells. In the Roselea eastern extension area the Cal-Standard Virden 2-26 well (1sd 2-26-10-26WPM), offsetting both the discovery well and the first north offset and only half a mile east of the nearest well in the main pool, was completed as a dry hole. At White-

(Continued on page 184)

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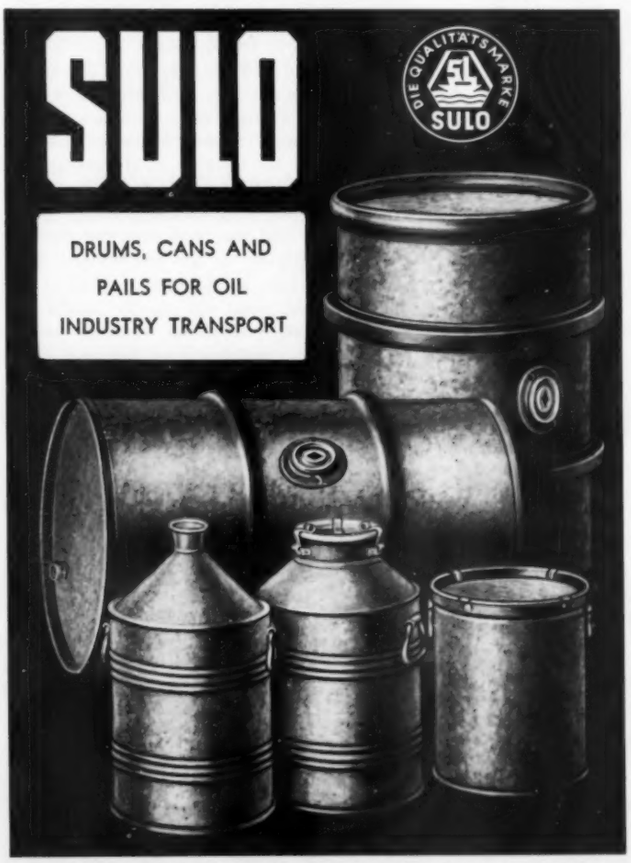

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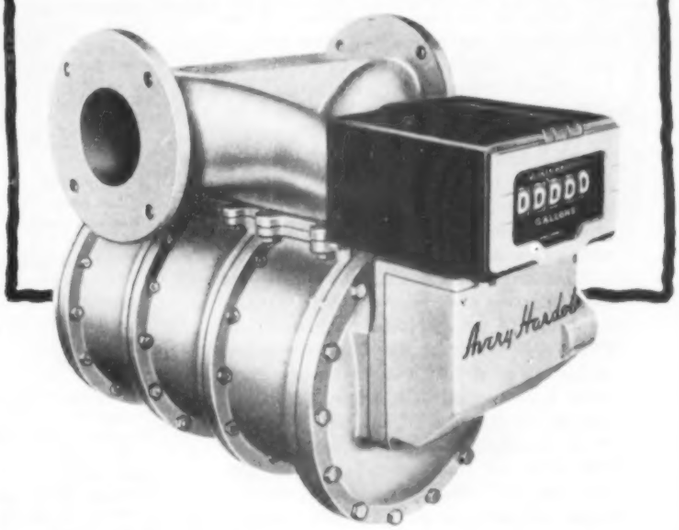

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Manitoba Production

(Continued from page 182)

water the Cal-Standard 2-20 well (1sd 2-20-3-21WPM) was also abandoned as noncommercial although it offsets the first northwest offset to the discovery well.

Completion practice has changed since the early stages of development. In the interests of economy, and feasible because of its low porosity and permeability in most wells, a number of Daly field producers were drilled with rotary rigs only to the top of the indicated pay zone, completion through the zone being effected with cable tool rigs and production casing being set as high as possible. It has been found, however, that the risk of water intrusion makes it preferable to run production casing right through the pay zone and a short distance below, using a rotary rig to completion depth. Cementing is done with enough for at least a 750-foot fill-up. Usually 300 feet of 9⅝-inch or 10¾-inch surface casing are cemented to surface. The production string is usually 7, 6⅝ or 5½-inch.

Most wells are placed on pump, and most pumpers are given a Sandfrac treatment before being placed on production. This is a patented Halliburton process, consisting of a fluid fracturing operation using a viscous oil with a propping agent to hold the fractures open. The objective is to increase permeability around the well bore and thus increase the oil flow rate without fracturing any potential water intrusion zones. It is now possible to secure selective Sandfrac treatment, with small intervals being worked, and results to date appear to justify the additional cost of this form of completion. It has also been applied to some of the flowing wells with good results. Completion methods have been reduced from a considerable diversity in the earlier stages to this fairly standardized operation.

The extent of drilling to date has made possible the construction of an intelligible stratigraphic table, the table included with this article having been revised from the first table constructed by John Ower a year and a half ago. The principal changes have been the substitution of the new Bakkan formation name for the previous designation of "Basal or Englewood, including Banff sands," and the classification of the upper Mississippian as partly Mission Canyon as well as Lodgepole. Minor changes have been made in the Devonian section, including the replacement of Moose Jaw by Nisku plus Duperow and the substitution of Dawson Bay for Hudsons Bay as a submember of the Manitoba formation, after the name of the bay on Lake Winnipegosis on which outcrops of this Devonian member have been observed. The Mission Canyon is not yet conclusively correlated with the Mississippian member of the same name in southeastern Saskatchewan, and stratigraphy is still complicated somewhat by the use of identical names referring to formations or members which are dissimilar in different geographical locations.

The type sections derived from the two basic wells, Cal-Standard Daly 15-18 and Cal-Standard Ewart 4-14, have not been improved on in subsequent drilling. For reference, their logs are appended, the Daly well being accepted as the best below the Silurian top and the Ewart well most satisfactory in quality of electrolog to its bottom in the Silurian top, thus making a composite log.

CAL-STANDARD DALY 15-18
Location 1sd 15-18-10-27WPM
Elevations: ground 1,608.2 ft., K. B. 1,620 ft.
Formation tops:

Cretaceous	
First specks	890 ft.
Second specks	1,160 "
Ashville	1,280 "
Swan River	1,540 "
Jurassic	
Sandstone and shale	1,595 "
Lime	2,120 "
Anhydrite	2,130 "
Red Beds (Amaranth)	not present
Mississippian	
Charles (?)	2,190 "
Madison equivalent	2,224 "
Exshaw	2,505 "
Devonian	
Lyleton shale	2,510 "
Jefferson equivalent	2,595 "
Red beds	3,730 "
Salt	3,770 "
Winnipegosan dolomite	4,132 "
Ashern	4,175 "
Silurian (Interlake)	4,240 "
Sand grains	4,505 and 4,555 "
Ordovician	
Stony Mountain, upper	4,580 "
Stony Mountain shale member	4,680 "
Red River	4,745 "
Winnipeg	5,210 "
Precambrian	5,359 "

CAL-STANDARD EWART PROVINCE 4-14
Location 1sd 4-14-8-28WPM
Elevations: ground 1,599 ft., K. B. 1,611 ft.
Formation tops:

Cretaceous	
First specks	1,075 ft.
Second specks	1,320 "
Swan River	1,800 "
Jurassic	1,850 "
Limestone	2,370 "
Red Beds	2,510 "
Mississippian	2,532 "
Exshaw	2,880 "
Devonian	
Lyleton shale	2,900 "
Upper Devonian	2,995 "
Red Beds	4,095 "
Salt	4,140 "
Winnipegosan	4,519 "
Ashern	4,575 "
Silurian	
Interlake	4,625 "
Total depth	4,818 "

The most significant discoveries of the past year have been the group of five in the immediate vicinity of the town of Virden in southwestern Manitoba, eight miles northeast of the Daly oil field. The initial discovery in this area was made in July 1953, establishing the Virden-Roselea oil pool. The discovery well, McIvor Roselea 1, 1sd 9-28-10-26WPM, ground elevation 1,466 feet, was completed on July 29, 1953, at total depth of 2,101 feet (623 feet subsea), set production casing at 2,050 feet, and was placed on open flow July 31, producing from the Mississippian limestone formation, top at 1,976 feet and 30 feet of net pay. Initial potential was 140 b/d of 35 gravity oil.

The first extension discovery was of the Scallion pool three miles north, by California-Standard Scallion Province 3-11, 1sd 3-11-11-26WPM, ground elevation 1,472 feet, completed on December 10, 1953, at a total depth of 2,025 feet (546 feet subsea), and placed on pump production December 23.

A second extension discovery nearly two miles east was made by Canadian Devonian Hepburn 1, 1sd 16-23-10-26WPM, ground elevation 1,411 feet, which was completed on December 29, 1953, at a total depth of 2,029 feet (600 feet subsea), set production casing December 31, and was placed on pump January 10, 1954.

Two other discoveries in the area each consisted of only one well at the middle of March. The first completed was four miles southeast of the Roselea pool, Cal-Standard South Virden 1-12, 1sd 1-12-10-26WPM, ground elevation 1,432 feet, which was completed on February 8, 1954, at a total depth of 2,405 feet (963 feet subsea), plugged back to 2,170 feet and placed on pump production March 15. The other has the distinction of being the shallowest producing well in Manitoba, due to its location in the bottom of the deep valley of the Assiniboine River, a glaciated landmark ranging from a mile to three miles in width, and about 200 to 250 feet below the general land surface. This well, J. P. Owen Bekker 13-32-10-25, 1sd 13-32-10-25WPM, ground elevation 1,210 feet, is three miles northeast of the Roselea pool and the same distance southeast of the Scallion pool. It was completed on February 12, 1954 at 1,747 feet, deepened February 24 to final total depth of 1,759 feet (539 feet subsea), set production casing, and was last reported pumping into tankage at an undisclosed but commercial rate at the end of March.

Manitoba's rapid rise to the ranks of significant oil production, and its prior maturity as a refining area for the eastern Prairies, hold out the prospect of an integrated oil economy for this outpost of the Williston Basin, with production probably matching regional refining capacity by the end of 1955. The combination of extremely low drilling costs, a proven prolific formation as a search objective, the absence of any seismograph interpretation which can either confirm or write off any given area without its being drilled out, the light gravity (34 to 35° API) and relative freedom from sulfur of the crude, and the proximity of the main crude oil pipe line leading to the marketing centers of eastern Canada, all make Manitoba a desirable oil province. The present intensity of wildcat drilling, amounting to less than one well per township of 36 square miles, leaves a great deal of prospective territory to be worked over.

C. S. Reed

Elected Cabot Executive Vice President

Russell G. Allen has been elected executive vice president of Godfrey L. Cabot, Inc., Boston, Mass., chemicals manufacturing firm. He succeeds Thomas D. Cabot, whose election as president was announced on March 1. Mr. Allen joined the Cabot organization in Texas in 1925 and became a vice president in 1943.

Leaves Interior Department's Oil and Gas Division

Edward B. Swanson, assistant director of the Oil and Gas Division, U. S. Department of the Interior, retired March 31 on completion of 34 years of government service. He started in 1920 as private secretary to the director of the Bureau of Mines.

After more than 14 years with the Bureau of Mines, Mr. Swanson served successively with the former Petroleum Administrative Board and as associate director of the Petroleum Conservation Division, Interior Department. In 1941 he was named director of research in the Office of the Petroleum Coordinator for National Defense, predecessor of the Petroleum Administration for War.

In 1946, Mr. Swanson became assistant director of the Oil and Gas Division, peacetime successor to PAW, and also served as chief of the Supply and Economics Branch of the Division. He has been closely associated for many years with the administration of the Connally Act, which prohibits interstate shipment of petroleum produced in violation of state conservation laws. He holds the Department of the Interior's highest tribute for public service, the Distinguished Service Award and Gold Medal, presented to him on November 2, 1950.

E. B. Swanson

Retires As Lummus Chairman

Carl S. Reed has retired as chairman of The Lummus Company, New York design and construction engineers for the petroleum and chemical industries. Mr. Reed succeeded Walter E. Lummus as president of the company in 1931. He has been chairman since 1949. J. F. Thornton succeeded Mr. Reed as president of the company in 1951.

Heads European Operations

S. Riley Williams, Worthington Corp. vice president in charge of foreign business, has appointed B. R. McBath as general European manager. Mr. McBath's offices will be with the French-Worthington Company, Paris. He joined Worthington in 1928 and was assistant to the vice president in charge of manufacturing before his present appointment.

McKee Earnings Higher

Net income of Arthur G. McKee & Co. for 1953 established a new high record for the third consecutive year. Consolidated net profit last year was $2,498,263, equal to $4.94 a share on the 505,382 shares of common stock outstanding. The figure represented a slight increase over the $2,454,884 ($4.86 a share) earned in 1952. The backlog of work on hand on December 31, 1953 amounted to $62 million.

Synthetic Phenol Plant

Standard Oil Co. of California has placed on stream a synthetic phenol plant at its Richmond, Calif., refinery. The unit will produce 35 million pounds of phenol and 20 million pounds of acetone annually. It is the first commercial plant to produce phenol from cumene in the United States. A similar plant has been operating in Canada for a year under license from Hercules Powder Co.

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Saskatchewan

(Continued from page 131)

exploration and development in Saskatchewan. To have some measure of comparison, the overall United States statistics for 1946 to 1951 are also quoted wherever these are available.

	SASKATCHEWAN 1953	U.S.A. 1946-1951
Barrels discovered per well drilled	89,000	93,500
Barrels discovered per foot drilled	26	26
Barrels discovered per barrel produced	21.5	1.72
Footage drilled per average well	3,430	3,557
Footage drilled per 1,000 barrels produced	827	65.3
Barrels discovered per $ total expenditure	1	?

The above shows that the Saskatchewan statistics are quite similar to U. S. statistics, except when production is used as one of the parameters. This emphasizes once more the fact that Saskatchewan is still in the exploratory stage of its development which is also indicated by the cost of $1.00 for each barrel of oil discovered.

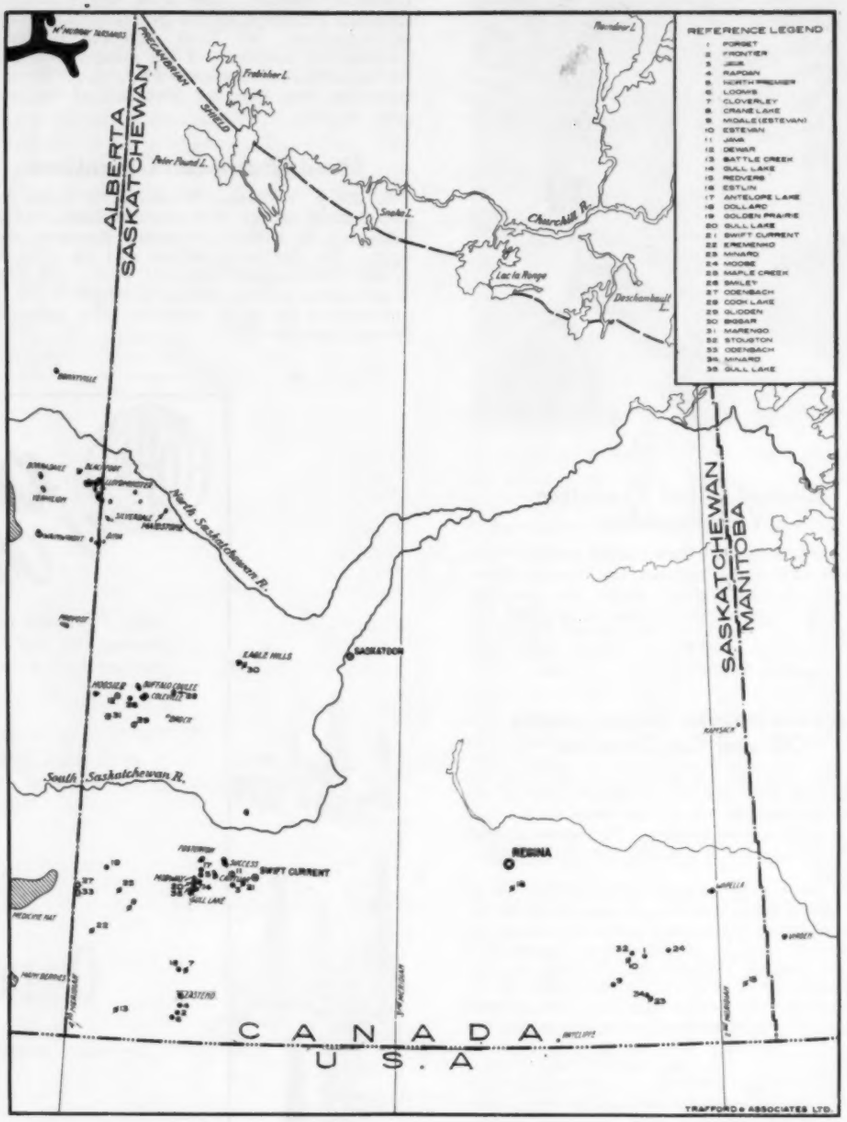
Although the activity in 1953 was spread over the entire southern part of the province, practically all the new discoveries were found in the western and eastern parts of Saskatchewan with no strikes in the central stretch between Swift Current and Regina.

In the west the oil and gas finds were located around Coleville, to the west and south of Fosterton, and in the east between Wapella and Ratcliffe.

Geophysical work carried out by the various companies played an important part in the 1953 exploration program. Some 270 seismograph, 30 gravity meter and 15 magnetometer crew months were spent, of which over 80 percent was carried out by five major oil companies, namely Socony-Vacuum, Tide Water, Imperial, Shell and the California Standard Oil Company.

Modernization and expansion of existing refinery plants was undertaken in 1953 with part of the work to be completed in 1954. Upon completion of this construction work, the province's refining capacity will be some 65,000 barrels per day, 12,500 barrels more than at the start of 1953. The refinery capacity will then be made up of 22.000 barrels for Imperial in Regina; 15,000 barrels for British American in Moose Jaw; 12,000 barrels for Co-op in Regina; 6,500 barrels for Hi-Way in Saskatoon; 3,000 barrels for Franco Oils in Lone Rock; 2,000 barrels for Moose Jaw Refineries in Moose Jaw; 1,500 barrels for Royalite in Coleville; and three 1,000-barrel refineries in Prince Albert, Moose Jaw and Kamsack.

The Saskatchewan Government kept pace with the province's oil and gas progress. New oil regulations became effective in February 1953 after some 14 months of study. Gas policy was formulated with regard to export from the province. As well as providing a guarantee for the provincial demand, the policy will give to producers that incentive required to go out, discover and develop the province's gas resources. An indication of the future government policy for the disposal of Crown Reserves oil rights in Saskatchewan was issued August 11 in an offer of 34 quarter-sections of proven, semi-proven and marginal acreage for public bid. Whether this will continue to be the government policy is a matter that is not yet completely clear in everyone's mind. It is felt that results of the sale will have influenced the government's thinking in the adoption of a permanent policy.



Map of southern Saskatchewan showing location of principal fields.

Exploration Highlights in 1953

Exploration activities paid off encouragingly in Saskatchewan during 1953, new strikes being reported practically every month of the year. Because of the varied nomenclature in the Jurassic formation in Saskatchewan, a correlation table is shown in Figure 1 (page 188) for the subdivisions used in the text.

January: The year started off with a sensational discovery of 29.5° gravity oil with an indicated flow rate of more than 3,000 b/d at the wholly-owned Tide Water wildcat 50 miles southwest of Wapella, Tide Water Forget Crown No. 1, Lsd 2-11-9-7 W2 (Ref. No. 1 on map). This well found close to 20 feet of Mississippian limestone productive at a depth of 3,900 feet, the same formation that is commercially productive at Ratcliffe, 60 miles southwest, at below 6,300 feet, and at Virden, Manitoba, 70 miles east. It was rated the most significant well drilled in the Saskatchewan portion of the Williston

(Continued on page 188)

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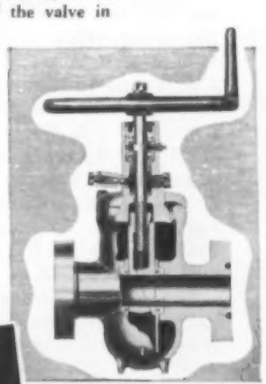

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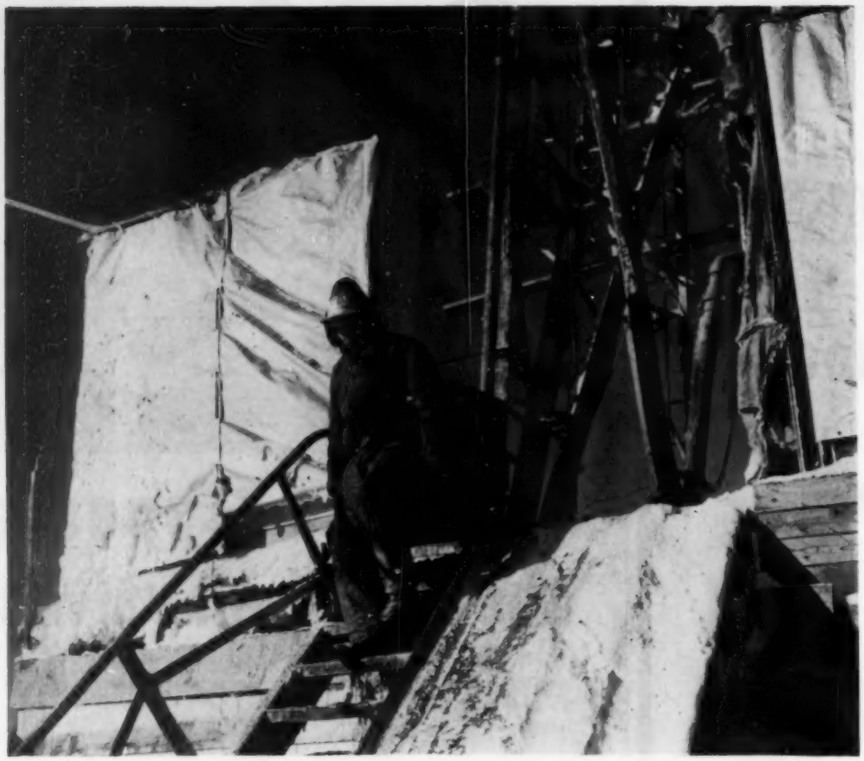

Canvas windbreaker used to protect drilling crew in winter from effects of cold winds prevalent on the western prairies. Photo courtesy Imperial Oil Ltd.

JURASSIC TABLE OF FORMATIONS

J-1	A	VANGUARD	UPPER
	B		MID.
	C		LOWER
J-2	A	(HULETT)	UPPER
	B	SHAUNAVON	LOWER
J-3		GRAVELBOURG	
J-4	A		
	B	WATROUS	

Figure 1. Table of correlating Jurassic formations found in Saskatchewan.

Saskatchewan

(Continued from page 186)

Basin and touched off a land boom of major proportions which resulted in all available mineral rights being leased over a large area.

This discovery was the third in succession for the Tide Water Associated Oil Co. group, after drilling some 17 dry holes over a period of two years. Their first two discoveries were in Eastend and Wapella, both medium oil strikes. A fourth for Tide Water was the discovery of 20° gravity crude in the Jurassic formation at the Frontier well, Lsd 13-21-3-20 W3 (Ref. No. 2 on map), some six miles south of the Eastend Jurassic find of 1952, close to the U. S. border in southwest Saskatchewan.

Tide Water's sudden success rate was maintained with the drilling of two more medium crude discoveries in the southwest. Tide Water Java Crown No. 1, Lsd 16-29-15-15 W3 (Ref. No. 3), found 20-21° gravity crude in some 25 feet of Jurassic sand at an approximate depth of 3,200 feet. This well is situated some nine miles east of the Success field and nine miles west of Swift Current. At Rapdan (Ref. No. 4), between the Eastend and Frontier wells, Tide Water found about 35 feet of Jurassic sand production of 23° gravity crude at a depth of approximately 4,580 feet.

Socony - Vacuum Exploration Co., the discoverers of the Fosterton, Cantaur, and Success fields, added another success to their list. Socony-Woodley Southern North Premier No. 30-4B, Lsd 4-30-15-18 W3 (Ref. No. 5) found two zones productive. Crude of 23° gravity was recovered from 26 feet of the Cretaceous Roseray sand at an approximate depth of 3,250 feet, and 23° gravity crude was indicated in the Hulett sand of the Jurassic J2A formation at some 3,500 feet. This well is some eight miles south of Fosterton field and ten miles west of Success field. The combined area started taking on the appearance of a major oil accumulation.

These discoveries closed off the month of January as an auspicious beginning of the new year. February seemed doubly quiet with no new finds reported.

March showed a slight improvement with one medium oil strike and two near "hits" abandoned as non-commercial.

The Tide Water group discovered 20° gravity crude in the Jurassic formation (J2B) in its Tide Water Loomis Crown No. 1 well, Lsd 5-1-3-21 W3 (Ref. No. 6), a few miles southwest of its Frontier well, indicating a possible widespread oil accumulation in the Jurassic in the general Eastend area. Some 18 miles to the north of Eastend proper, Tide Water Cloverley Crown No. 1, Lsd 1-18-7-19 W3 (Ref. No. 7), found a noncommercial medium oil show in the Jurassic and was subsequently abandoned. The second near hit was drilled and abandoned by the Amurex-Albercan team in the Crane Lake area at their Russell 1-4 location, Lsd 4-34-12-25 W3 (Ref. No. 8). Some 18 feet of Jurassic, J2A, indicated spotted oil saturation with a little oil recovery from the top. The formation was too tight for commercial production.

April: Shell Oil Co. of Canada scored its first success in Saskatchewan in April with a dual crude strike in the Mississippian formation. The well, Shell Estevan No. 2, Lsd 7-18-6-10 W2 (Ref. No. 9), tested 26-27° gravity crude from 44 feet of the Charles Limestone (Mississippian) at approximately 4,600 feet. Some 109 barrels flowed in 15 hours. Later this zone tested 400 barrels per day on a 5/16-inch choke. One hundred feet deeper, 30.4° gravity crude was recovered from the Mission Canyon (Mississippian) formation. This well is located in the Saskatchewan Williston Basin area, some 25 miles southwest of the Forget light oil find in the same formation. Shell Estevan No. 1, Lsd 6-24-8-9 W2 (Ref. No. 10), about eight miles west-southwest of Forget, found only oil cut mud and was abandoned. Later the Estevan No. 2 well was renamed Shell Midale A7-18 and forms the nucleus of the Midale field.

Two gas discoveries were also reported in this month. Tide Water Java Crown No. 10-29, Lsd 10-29-15-15 W3 (Ref. No. 11), six miles north of the Java Jurassic medium oil discovery, blew two million cubic feet of gas from the Jurassic formation at approximately 3,200 feet.

Five million cubic feet of gas was

(Continued on page 190)

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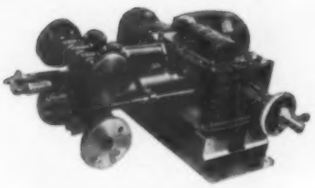
Solenoid-operated plunger pump with variable stroke and speed



Duplex high-duty pump with mechanically operated suction valves.

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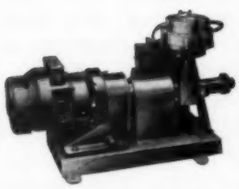

Single-stage gas pump Suction 75 mm. Hg absolute to delivery press : 5 lb. per sq. inch gauge.

DIAPHRAGM PUMPS in single units are made in a range of standard sizes covering capacities of from 1 to 1,000 gals. per hour at normal pressures. These pumps are made also as multiple units.
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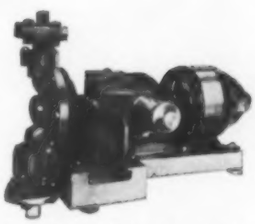

Standard G/250 diaphragm pump with micro-variable control.

PLUNGER PUMPS as single units with ram diameters of from $\frac{1}{2}$-in. dia. to 4-in. dia. and capacities of from 5 ml. to 500 gallons per hour and pressures up to 20,000 lb. per square inch.
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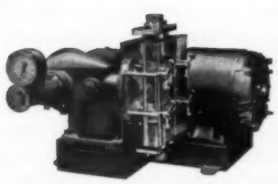

Diaphragm pump micro-capacity control with dial-type stroke adjustment indicator.

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Standard G/250 plunger pump Low-pressure type with micro-control.

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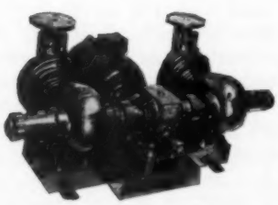
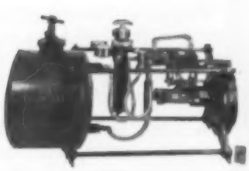
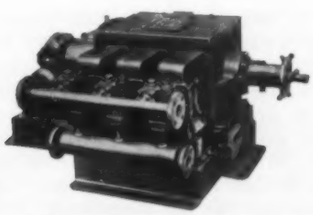


Twin G/250 diaphragm pumps. Can be supplied in multiple units of eight or ten pumps.



Pneumatic chemical feeder driven by natural gas or compressed air.



Treble plunger pump with micro-variable volume control. High volumetric efficiency straight-line variable capacity.

Blaster cutting explosive for seismic shot hole. Socony-Vacuum photo.

Saskatchewan

(Continued from page 188)

tested on a formation test of the Viking sand at 2,380 feet in the well Canada Southern Dewar No. 6-14, Lsd 6-14-31-26 W3 (Ref. No. 12), four and one-half miles northeast of the Husky Phillips Dewar No. 1 heavy oil find and seven miles west of Canada Southern Dewar No. 4-24, another Viking gas discovery.

May: A new oil productive zone was found in the Gull Lake field, south of Fosterton. Anglo American Gridoil Gull Lake No. 6-13, Lsd 6-13-13-19 W3 (Ref. No. 14), found 22° gravity crude in the Blairmore sand at some 3,600 feet. This well was also a 23° gravity oil producer from the Jurassic J2A, a zone previously found productive in the Gull Lake field. The Blairmore tested one million cubic feet of gas and some oil in a one-mile offset to this well.

In the Battle Creek area in the most southwesterly corner of Saskatchewan, a follow-up well to a large gas discovery in the Jurassic (7.5 million cubic feet on test) proved a disappointment. Federated Coop. Canada Southern Imperial Calvan B. C. No. 1-27, Lsd 1-27-3-26 W3 (Ref. No. 13), was void of gas in the Jurassic. Some heavy 12° gravity crude was found in the Mississippian at 4,600 feet, but the well had to be abandoned because of water intrusion.

June: In June the general Fosterton area was highlighted again by a two and one-half mile northerly stepout from the North Premier well. Socony Woodley South Antelope Lake, Lsd 3-5-16-18 W3 (Ref. No. 17), reported oil-flecked mud from the Blairmore at 3,000 feet, medium oil from the Roseray sand at 3,150 feet, and medium oil from the Hulett section of the Jurassic at 3,350 feet.

In the most southeasterly corner of the province, an indication of 37° gravity crude was obtained from the Mission Canyon limestone (Mississippian) in the Redvers area at Socony Woodley South St. Antoine No. 1, Lsd 4-24-6-32 WPM (Ref. No. 15). Although 24 feet were reported as porous at 3,000 feet, the well was abandoned as non-commercial.

Non-commercial gas and oil in the Viking and Lower Cretaceous respectively were reported in a Socony-Vacuum well at Estlin, 1-20-15-19 W2 (Ref. No. 16), 15 miles south of Regina, which was subsequently abandoned.

July: The only discovery in July was reported in the Tide Water group's 5-21 well at Dollard, Lsd 5-21-7-20 W3 (Ref. No. 18), where 18° gravity crude was recovered from the Jurassic J2A at 4,550 feet. Swab tests showed an entrance rate of 10 barrels per hour.

August: Development in the Gull Lake area in August revealed 12.9° gravity heavy oil in the so-called Lower Shaunavon or J2B section of the Jurassic in Socony Woodley Southern Southeast Midway No. 3-1, Lsd 1-3-14-19 W3 (Ref. No. 20), in addition to the J2A medium oil.

An adjacent well, Grid Oil-Gull Lake No. 14-14A, Lsd 14-14-13-19 W3 (Ref. No. 20), tested six million cubic feet and some medium oil in the Blairmore as well as medium oil in the J2A Jurassic.

Amurex-Albercan Frank No. 1-4, Lsd 4-3-16-27 W3 (Ref. No. 19), in the Golden Prairie area some 55 miles west of Fosterton, found 14° gravity oil in the top J2A or Hulett section of the Jurassic at 3,250 feet. The well tested 20 barrels fluid per day with 60 percent oil. In the Java area Canada Southern Swift Current No. 10-4, Lsd 10-4-15-14 W3 (Ref. No. 21), had a showing of oil in the Cantuar sand but was abandoned as non-commercial.

Two other oil shows were abandoned in August. Amurex Albercan Fremenko No. 1-7, Lsd 7-17-10-28 W3 (Ref. No. 22), reported some non-commercial heavy oil in the Hulett section of the Jurassic and a stepout to Midale in the Minard area, Shell No. A1-4, Lsd 1-4-5-7 W2 (Ref. No. 23), found medium oil in the Charles limestone of the Mississippian, but in non-commercial quantities.

September: This month saw the first light crude discovery in Western Saskatchewan just southwest of the heavy crude Coleville field. Imperial Smiley No. 7-15V-31-25, Lsd 7-15-31-25 W3 (Ref. No. 26), tested 36° gravity crude from some 20 feet of Viking sand at a depth of 2,300 feet. Prior to the commercial oil discovery, this horizon had only shown the presence of gas and minor shows of light gravity oil in this area. Upon completion this well rated some 100 barrels per day.

Great optimism prevailed at that time and the general opinion was that a major light oil field had been drilled into with a reserve of at least 100 million barrels. Development proceeded immediately at a rate of about four wells per week. Imperial Oil Ltd. and Canada Southern were the largest operators in the area. Since that time it has become apparent that the productive area is not as large as originally thought. Also production problems were many, such as brackish water production, high gas/oil ratio wells, and serious wax problems, especially in the winter months. Although it is believed that these difficulties can and will be remedied,

(Continued on page 193)

REFINERY PROCESS NEWS

PUBLISHED BY REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAY 1954

Four K. I. C. Projects Now Underway Involve Over $200 Million

Investment expenditures totaling the equivalent of over $200 million will be made by Kellogg's clients for just four of the many projects currently under construction by Kellogg International Corporation, Kellogg's wholly owned subsidiary for contracts outside the Americas. Already well along in construction, the projects include a vast gasoline-from-coal synthesis plant in South Africa; a complete catalytic refinery in Australia large enough to supply almost half that country's petroleum needs; a completely integrated, thermal combination refinery in Baghdad for the Royal Government of Iraq; and plants for producing phthalic anhydride and olefins for Montecatini, well known Italian chemical producer.

First Use of Synthol Process

The South African plant, under construction for SASOL (South African Coal, Oil, and Gas Corporation Ltd.) is expected to go on stream by the end of the year. When completed, it will produce gasoline, fuel oil, and a long list of by-product chemicals, using as starting material coal from virgin deposits near the plant site.

Kellogg's Synthol process, a unique step for catalytically reacting gases from the controlled combustion of coal, constitutes the heart of the entire operation. Additional gasoline is produced in subsequent steps when light hydrocarbons formed in the Synthol process are polymerized. The water soluble fractions—also produced in the synthesis step—are separated into their chemical components.

Refineries in Remote Areas

The two petroleum refineries are scheduled for completion in 1955. They underscore the tremendous undertakings involved in building self-contained industries in relatively unindustrialized parts of the world. For example, in addition to the actual 70,000 BPD refinery, the Australian project includes a

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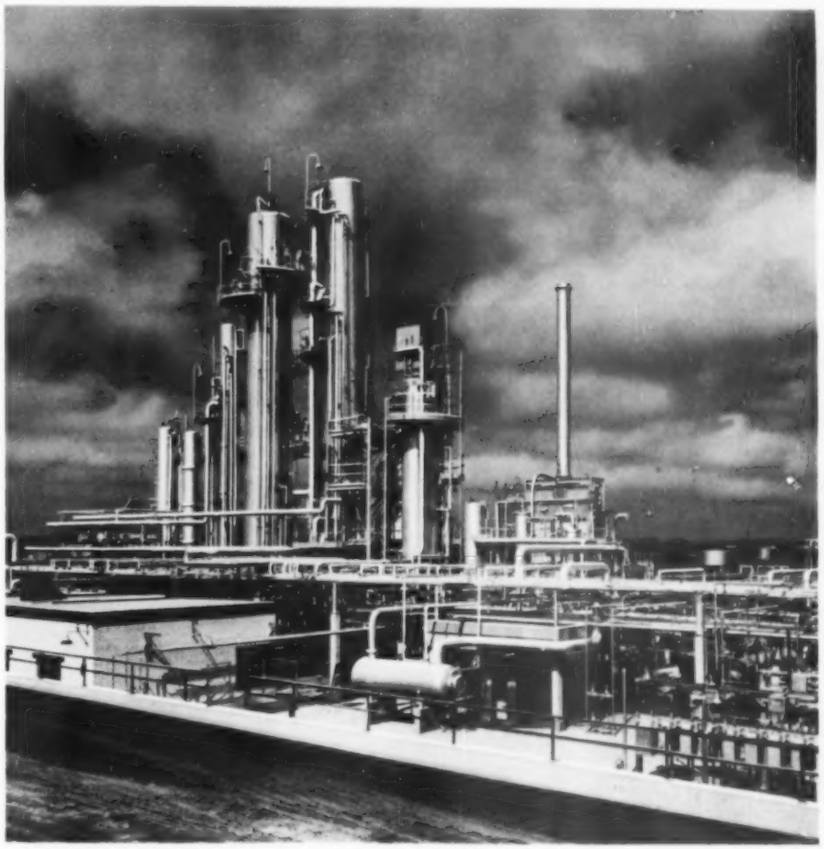


New Solvent Lube Plant Underscores the Efficiency and Quality Production of Improved Propane and Phenol Treating

Still on its initial run after 11 months on-stream, one of the world's most modern solvent extraction lube oil plants—designed and built by Kellogg for a Midwest refiner—has turned in an impressive operating record. High on the list of the plant's achievements are increased yields of premium products and an ability to maintain quality while processing feed stocks of lower-than-design specification.

Propane deasphalting and phenol extraction units are the heart of the plant. Both processes incorporate a number of design changes developed as a result of Kellogg's pilot-plant operations. For example, trays in the phenol extraction tower are of a special design which minimizes entrainment or "re-cycling." Because the two liquid phases settle or "de-mix" more effectively, this provides in effect an increase in the number of theoretical extraction stages. Still another design feature is incorporated in the phenol extraction tower to give a cleaner, sharper, more easily controlled interface between the liquids—a decided improvement over conventional versions of gravity extraction towers.

Some indication of the efficiency of the plant can be seen in some of the results obtained during test operations. From a reduced crude with 7.5 Conradson carbon, the propane deasphalter produced a yield of 75.6% deasphalted oil with 1.82 Conradson carbon. In the phenol extraction unit, a yield of 63.9% of

(continued on following page)

REFINERY PROCESS NEWS

CONTINUED FROM PRECEDING PAGE

(continued from previous page)

New Lube Plant...

95.2 VI oil was obtained from a deasphalted oil charge, and a yield of 62.5% of 95.1 VI oil was produced from an 80 neutral feed stock.

The impressive performance of modernized propane deasphalting and phenol treating witnessed to date in the new plant is in logical sequence with Kellogg's earlier developments in both of these techniques. The company was the originator of "Tower Deasphalting"—now well known to all refiners as the process that radically changed the significance of the term "select crude." As a result of this development, asphalt content is no longer a measure of the potentiality of any crude for processing into premium lube oils.

A continuous low temperature operation that precludes cracking, tower deasphalting is now the accepted method for completely removing the asphalt from any crude in a single, economical step—and further—it uses as solvent a product the refiner already has at hand.

Counter-current extraction with phenol, an equally pace-setting development in lube processing, has become a standard method for improving the viscosity index and stability of all types of residuals as well as distillate oils. The ability of phenol to remove naphthenic acids thoroughly and to handle stocks of high sulfur content satisfactorily (without loss of solvent through chemical reaction) is one of its most important advantages.

Some Facts About Delayed Coking

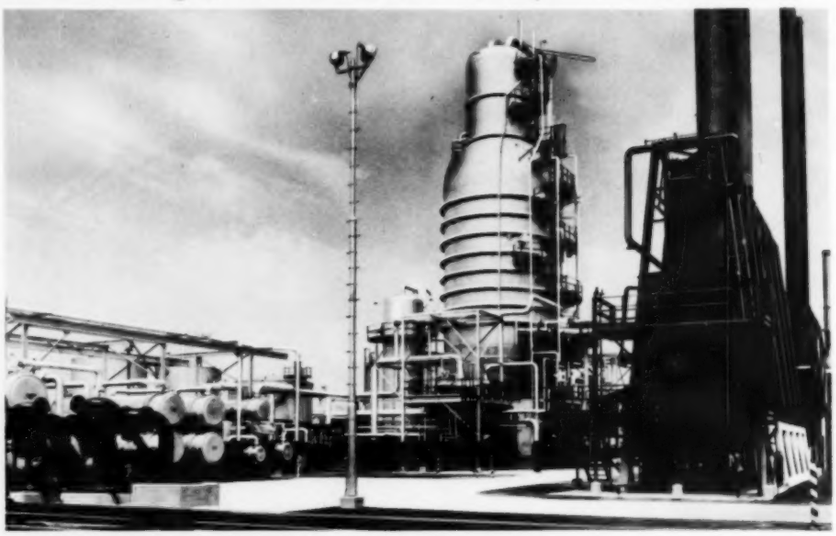
Did you know... that Kellogg has designed and built 63 per cent of the world's Delayed Coking capacity?

... that the world's largest Coker, built by Kellogg for a California refiner, has a throughput of 26,000 BDP, producing as by-product 1100 tons of coke per day?

... that process designs for Delayed Cokers have improved to such an extent that on-stream times of over a year may be readily obtained.

World's Largest Vacuum Flasher...

Above is shown the tower and furnaces for what will shortly be the largest Vacuum Flashing unit in the world—beating out by a slight margin the present title holder, shown below. Both of these Kellogg-built vacuum flashers are located at refineries of the Standard Oil Company of California, the new one at El Segundo, the other at Richmond.



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Over $200 Million...

1,700-foot pre-cast concrete jetty to accommodate ocean going tankers and two 17 mile pipe lines.

The two Montecatini projects are both unusual. The phthalic anhydride plant employs the Fluid catalytic process; the olefin plant produces ethylene and other olefins by the pyrolysis of gas oil and naphtha.

The South African and Australian projects, together with the 20,000 BPD refinery at Baghdad and the chemical plants in Italy, represent only a cross section of K. I. C.'s far-flung operations. From its London offices, the company supervises over-all construction, procurement, and labor recruitment for these as well as a score of other petroleum and chemical plants now building overseas.

For further information, technical data, etc., on any refining process, write

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Mast-type rig drilling on western prairies. Photo courtesy Socony-Vacuum Oil Co.

Saskatchewan

(Continued from page 190)

the latest published reserve estimates are on the order of 30 million barrels. Hi-Way Refineries is planning a pipe line from the field to the Interprovincial oil pipe line which passes to the north at a distance of approximately 25 miles.

Aside from the relative size of this field, this strike is considered of the greatest importance since it has opened up the possibility of other light oil accumulations in an area previously thought to be restricted to heavy oil only.

In the Moose area, close to Forget, 27° A.P.I. crude was encountered in some 40 feet of Mission Canyon limestone (Mississippian) at a depth of almost 4,000 feet. The well, Williston Bobjo No. 1-19, Lsd 1-19-9-6 W2 (Ref. No. 24), rated 20 barrels per hour on swab test and 260 barrels per day on a 24/64-inch flow bean.

In the meantime, exploration continued in all parts of the province, but no other discoveries were chalked up. Mention can be made of a well west of Fosterton, Maple Creek Moser No. 1-1, Lsd 1-17-14-26 W3 (Ref. No. 25), which found a small show of heavy to medium oil in the Jurassic J2B, but was abandoned as non-commercial.

October: A small gas well was completed in the extreme west of the Province as a potential producer from the Medicine Hat gas sand. Amurex Canada Southern Odenbach No. 1, Lsd 10-23-14-30 W3 (Ref. No. 27), appeared to have drilled into an extension of the Medicine Hat and Many Islands gas fields of Alberta which have producers and potential producers from the Medicine Hat gas sand.

November: Gas and light oil of 35-36° A.P.I. were encountered in the Viking sand of Canada Southern New Superior Cook Lake No. 11-32, Lsd 11-32-31-21 W3 (Ref. No. 28), in the Dodsland area, northeast of Coleville. Oil recovery was some ten barrels per day on swab tests. The well was completed, but rates as a marginal producer only.

December: The last month of 1953 was highly active and several interesting discoveries were reported. Phillips Husky Glidden No. 1, Lsd 7-14-27-24 W3 (Ref. No. 29), found more than 10 feet of Viking sand which produced gas at an open flow rate of 9.5 million cubic feet of gas. This well is some 25 miles west of Brock and if a sizable accumulation were proven, it would be situated highly favorably with respect to the Brock-Saskatoon gas pipe line.

An even larger Viking gas well was completed another 20 miles west of the Glidden well. Phillips Husky Marengo No. 1, Lsd 10-26-28-27 W3 (Ref. No. 31), found gas in the Viking at about 2,500 feet and rated an open flow capacity of 25 million cubic feet per day. This well discovered also 13.7° gravity crude in the detrital chert formation above the Mississippian some 400 feet deeper.

The Eagle Hills area was temporarily in the news with 13° gravity crude reported in some 10 feet of Blairmore in Edoran-Christie Biggar No. 2, Lsd 7-12-36-15 W3 (Ref. No. 30). Attempts to produce the oil were unsuccessful because the underlying water broke in immediately, whereupon the well was abandoned.

A six-mile extension of the Medicine Hat gas sand along the Alberta-Saskatchewan border was indicated by Amurex-Canada Southern Good No. 1, Lsd 11-24-13-30 W3 (Ref. No. 33), which tested 1.2 million cubic feet per day from that sand.

The Gull Lake area was once more highlighted before 1953 closed with the finding of 20° gravity crude in some 18 feet of the Mid Vanguard sand (J1B) in Gull Lake No. 15-23A, Lsd 15-23-13-19 W3 (Ref. No. 35). Previously oil had been found in this field in the Upper and Lower Shaunavon (J2A and J2B) and the Blairmore sand. The same well tested nine million cubic feet of gas per day from 47 feet of Basal Cantuar sand. The Blairmore also contains gas in this area.

In the Williston Basin section of the province, 28° gravity crude was discovered in the Mission Canyon (Mississippian) formation at a depth of 4,000 feet in Sohio Stoughton No. 4-13, Lsd 13-4-9-8 W2 (Ref. No. 32), some six miles west of Forget. A follow-up to Shell's Minard abandonment one mile to the north, in Lsd 16-4-5-7 W2, (Ref. No. 34), tested 330 feet of gas cut oil of 28° gravity from the Mission Canyon formation.

And so 1953 has come to a close. It has been an interesting year. So far, many of the discoveries are still only one-well "pools," but they are highly significant in establishing the presence of oil and gas in several horizons over widespread areas and their value to the encouragement of continued exploration is, as such, of great importance.

So far, none of the more developed fields has reached the status of a major field (at least 100 million barrels reserve), but it should be realized that many small ones make a sizable total. Saskatchewan has taken its place as Canada's second oil province and we watch with interest its continued growth.

Sun's Sarnia Refinery

(Continued from page 96)

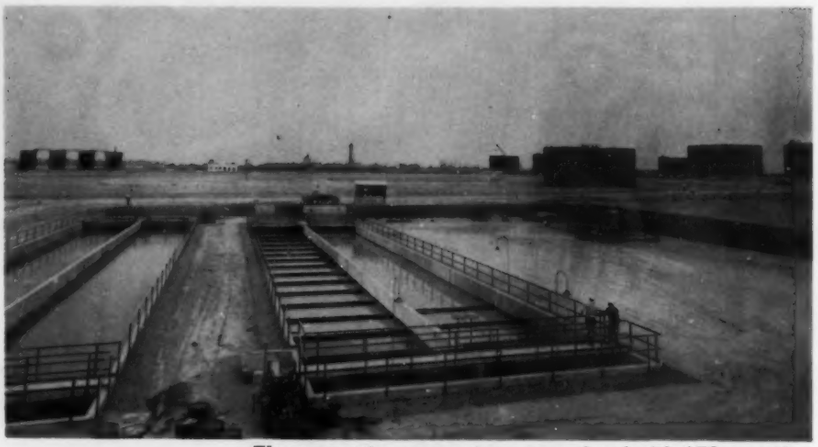
pumping of bilge water from lake vessels to keep their demurrage at a minimum. Then the separation of oil which is partially accomplished in these tanks can be completed in the contaminated storm water or process water separators over an extended period of time without exceeding their capacities. Two 1,000 barrel slop oil storage tanks, equipped with steam coils and desludging equipment, provide storage for oil recovered at the separators.

The primary portion of the steam required for the operation of the refinery is generated in two boilers each having a capacity of 25,000 pounds per hour of 450 psig steam with 200°F superheat. These boilers can be operated with steam turbine drives alone and therefore at all times insure a dependable supply of steam independent of electric power. During a power failure the emergency electric system provides the necessary power for the instrumentation used in controlling the boilers.

A large quantity of 450 psig saturated steam is produced by waste heat from the Houdriflow catalytic cracking unit, the synthetic crude unit and the Houdriformer. The regeneration of HCC unit catalyst is accomplished by the controlled burning of carbon off the catalyst and this waste heat is used for the generation of some 40,000 pounds per hour of high pressure steam. The quench stream of the synthetic crude unit produces some 15,000 pounds per hour of additional steam. Similarly the convection section of the Houdriformer heater is used for some 10,000 pounds per hour of steam. The 40 psig exhaust steam which is used for stripping in the distillation units is superheated in the convection section of the crude heater to improve its effectiveness.

The air compressor building houses the facilities for plant and instrument air, flue gas to be used in purging and emergency power. Two motor-driven air compressors having a total capacity of 700 scfm of air at 110 psig provide the plant and instrument air. The portion used for instrument purposes is dried to eliminate condensation and freezing in the instruments or in their air lines. In case of power failure, two steam-driven air compressors are used to supply the required instrument air demand.

In this same building are located the emergency turbo-generator and the flue gas compressor. The 50 KW turbo-generator, which automatically goes into operation during a power failure, provides power for the instruments, motor operated valves and lighting in the control house. The flue gas compressor takes suction from the stacks of the steam boilers and through a scrubber where it is cooled and cleaned with water. After compression this gas enters a piping network which distributes it to the various towers and vessels in the combination unit for purging purposes.



Three separate sewer systems are equipped with API separators to prevent stream pollution. These handle process water, contaminated storm water, and cooling water. The process waste water system makes use of the first bacteria installation at an oil refinery for phenol removal.

The electrical power for the refinery is obtained from the Hydro-Electric Power Commission of Ontario. A dual system is used in feeding the various substations. For some of the more critical services, such as the cooling water and fire protection water pumps, power can be resumed after the failure of one system by operating a throw-over switch to connect to the second system. In other services, where spare equipment is installed, the spares and the normal pieces are connected to different systems and should one fail the second system can be used.

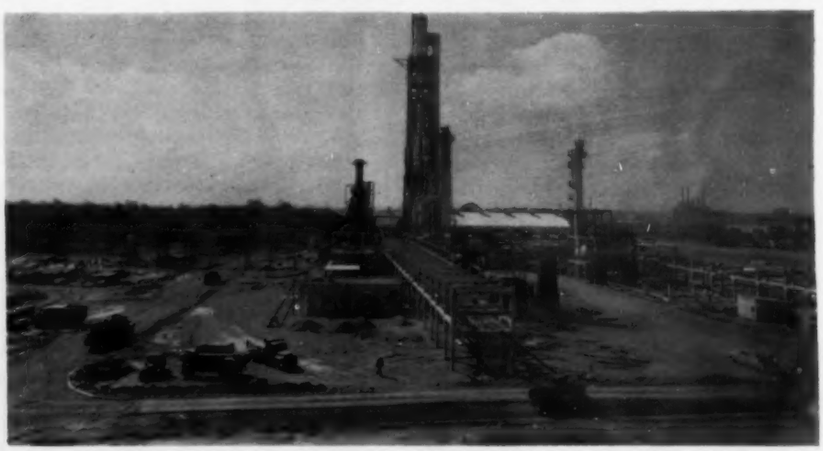
The combination unit is serviced by two fuel systems: fuel oil and refinery gas. The fuel oil system consists of a heated service fuel oil tank, pumps and a piping circuit which serves the process area and returns to the fuel oil tank. The fuel oil is obtained from the atmospheric flash tower bottoms. This fuel oil circuit has connections for the steam generators and the crude, reduced crude and recycle heaters. A separate fuel oil system using light catalytic gas oil provides fuel for the air heater of the Houdriflow catalytic cracking unit.

The refinery fuel gas system is supplied with dry gas from the Polymer Corporation and vent gas from the depropanizer, as well as off-gas from the Houdriformer. The first two streams serve as an alternate fuel to all fired equipment in the refinery. To permit the high hydrogen content of the Houdriformer off-gas to be handled by conventional burners, it must be blended with normal refinery gas. The bulk of this blended gas is burned in the reformer heater, with the balance going to the steam boilers.

In the interest of minimizing air pollution, an elaborate relief and blow-down system is installed. All gases relieved from the various pieces of operating equipment are collected in headers which enter a blowdown area located away from the combination unit area. Gases venting from this blowdown drum then go to a 150-foot flare stack, where they are burned.

(Continued on page 198)

General view of combination unit during construction showing Petrochem crude heater at left. Crude charge picks up about 43.5 million Btu/hr by exchange and 30 million in the heater to provide 45 percent vaporization in the flash zone of the crude tower.



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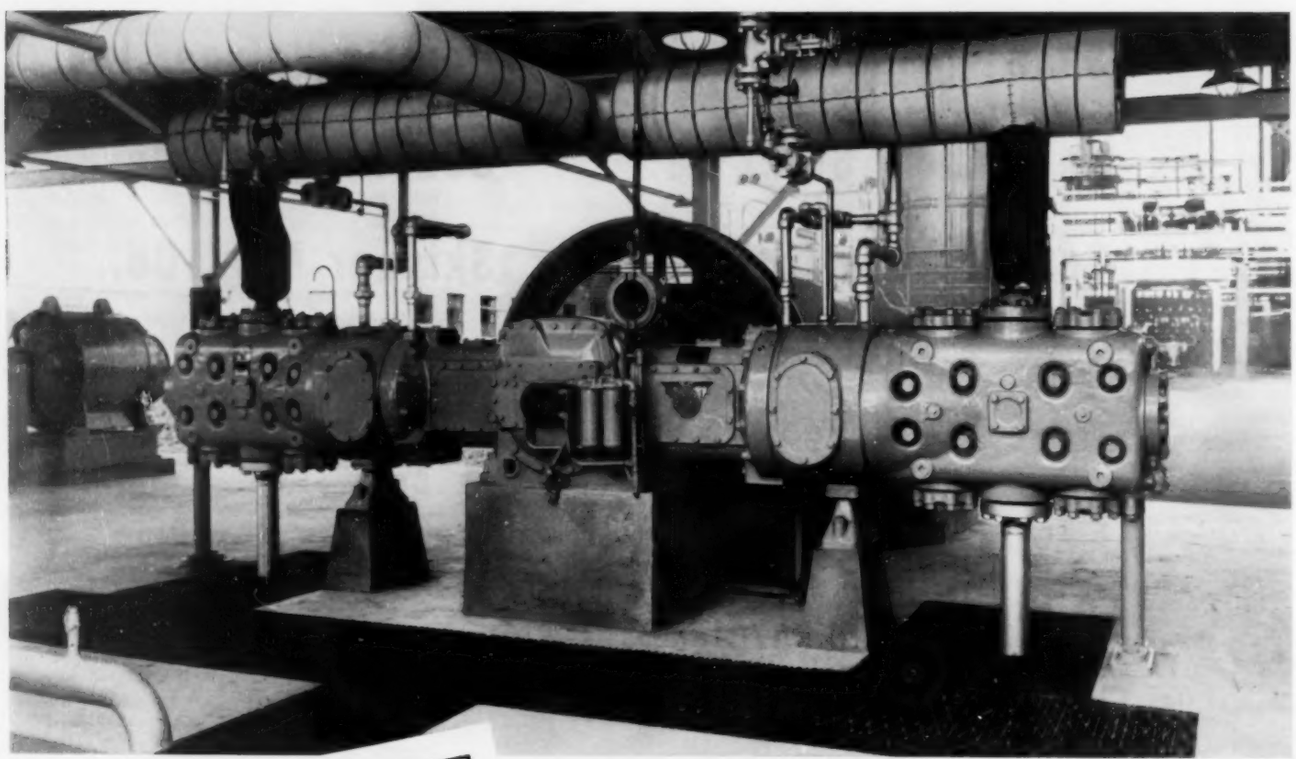

One of the two Cooper-Bessemer EM compressors, rated at 300 hp, serving in Canadian Oil's UOP Platforming operation. Note the simple, neat and compact arrangement of this "open air" unit.

ANGLE

Compressors

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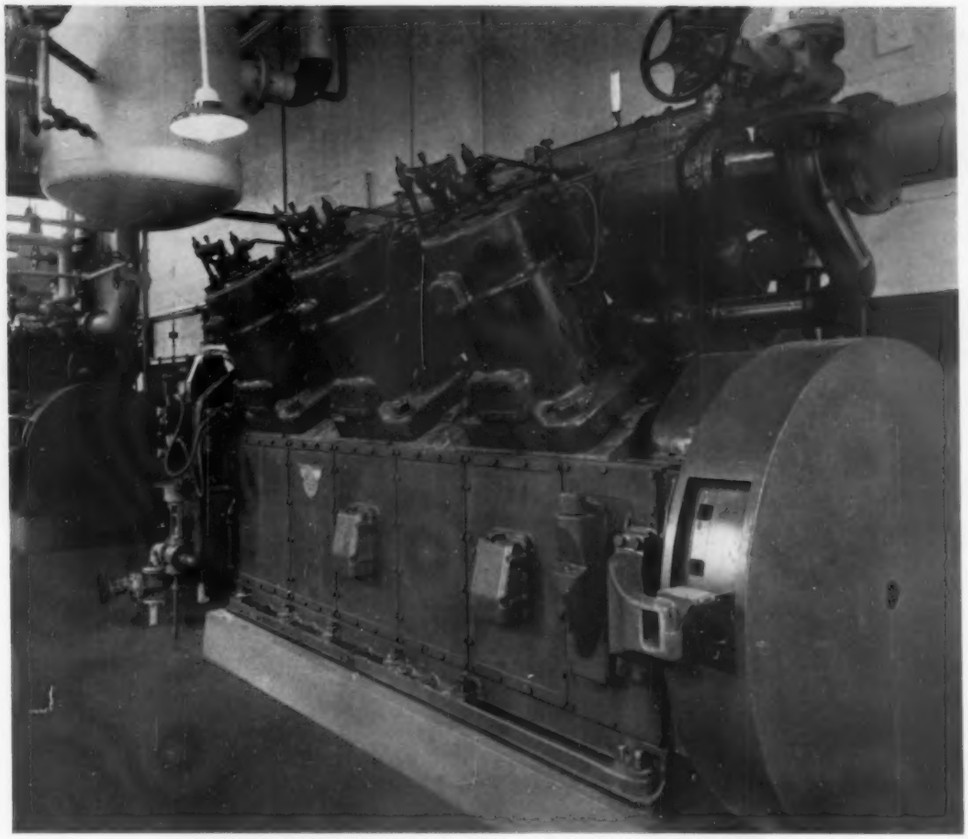

Two 6-cylinder Cooper-Bessemer GMX compressors, rated at 330 hp at 400 rpm, being installed to recirculate gas for the Houdriformer process at Sun Oil Company's new Sarnia, Ontario plant.

Cooper-Bessemer 2-cylinder EM's and 6-cylinder GMX's — offer efficient compressor service for two different oil companies employing different processes at Sarnia, Ontario.

AT the Sarnia refinery of Canadian Oil Refineries, Ltd., two motor-driven EM compressors recycle hydrogen for their new UOP Platforming unit. This unit, charging nearly 3800 barrels per stream day, produces high yields of gasoline with an octane number reaching well into the 90's. Equipped with non-lubricated cylinders, EM's play a vital and dependable role in this production of high octane gasoline.

And, for the new Houdriformer of a similar capacity at Sun Oil Company's Sarnia plant, two Cooper-Bessemer GMX V-angles, also with non-lubricated hydrogen cylinders, are used in the recirculation of gases. This catalytic reforming unit likewise upgrades low octane naphthas to high quality motor fuels.

Whether you are considering UOP Platforming, a Houdriformer, or other operations requiring compressors of virtually any type, — Cooper-Bessemer offers more than a century of reliable compressor building experience. Contact your nearest office for detailed information.

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Sun's Sarnia Refinery

(Continued from page 194)

When the temperature of the headers entering the blowdown drum rises to 180°F., indicating the venting of an abnormal quantity of gases, 400 gpm of water is introduced by automatic controls to spray nozzles in the drum for condensation of all condensables in the gases. Thus the amount of gases to the flare is reduced. The water for this quench system is supplied from the fire water system or the emergency cooling water system. The condensed oil drains by sewer to the water-oil separator area where the oil is removed and stored for reprocessing.

The 150-foot flare stack is equipped with a smokeless flare burner assembly. Steam, automatically controlled by the pressure of gases entering the flare, plays a multiple role in abating smoke. Primarily the steam enters into a water-gas reaction with the carbon particles which make up smoke and eliminates them. Also, this steam is used to inspirate excess air to the flame and to cause turbulence which assists the reaction. To insure positive lighting of all gases, the flare is provided with three pilots, each one having dual ignition systems, one using glow plugs and the other a flame front propagation in a tube.

Approximately two miles of railroad siding service the entire refinery. One spur runs along the side of the service building for handling warehouse materials. Another goes to the Ethyl blending building for the delivery of tank carloads of Ethyl fluid. A third spur is located at the Houdriflow catalytic cracking unit and is used for receipt of catalyst. Although not now included, it is possible that in the future tank car loading racks will be installed for the shipping of products by rail.

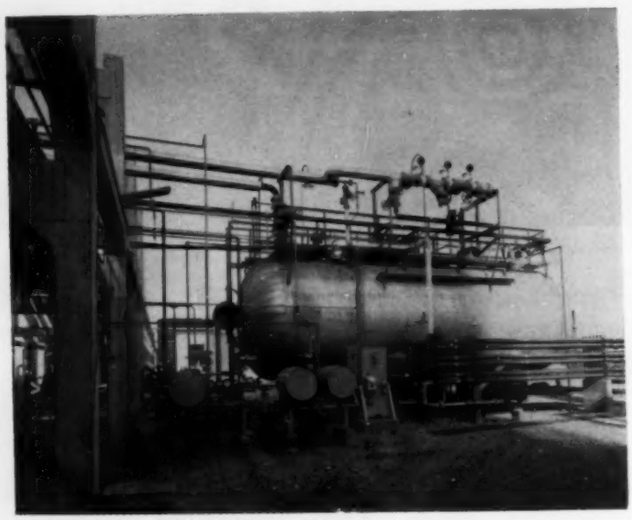
The products from this refinery may be distributed by barges and pipe lines. The refinery dock has facilities for loading barges with refined products. It can accommodate lake vessels having a loaded draft of 18 feet and has pipe lines for loading products at rates up to 4,000 barrels per hour. The pipe line outlets go to the bulk plant, located adjacent to the refinery, for local distribution and to the Sun-Canadian pipe line for distribution of products in the London, Hamilton and Toronto areas.

Sun Oil Company Ltd. has contracted with Catalytic Construction of Canada Ltd. for the performance of maintenance work at the Sarnia refinery. The scope of the work included in this contract consists of miscellaneous construction, revamp work and maintenance. An appreciable economy is realized with such a maintenance contract, since Catalytic has several similar contracts in this same area and is therefore able to make the most practical use of both the construction equipment and the force of experienced personnel by scheduling the work at the various plants.

The Catalytic maintenance force at the Sun refinery now consists of about 60 craftsmen and laborers, some two-thirds of whom are on scheduled shift work and the remainder are on day work. During a scheduled or emergency shutdown, this force could immediately be supplemented by construction workers from the local area to meet the necessary peak requirement. The refinery actually has no maintenance workers on its own payroll.

The beginning of operations in the refinery of Sun Oil Company Ltd. in Sarnia has been an important step in its career as the first refining to be done by Sun Oil Company in Canada. It has also been of considerable significance to the Canadian petroleum industry as the addition of another completely new refinery.

Combination unit pump area.
Photo was taken during construction period.



Crude is heated by exchange to 200-225° F before charging to the desalter, after which it picks up additional heat by exchange and enters the crude heater at 425° F.

Gas plant in which butanes and lighter gases are segregated for processing at the adjacent Polymer Corp. plant.

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THE SARNIA CHAMBER OF COMMERCE

SARNIA, ONTARIO, CANADA

INTERNATIONAL NEWS AND NOTES

Exports to Venezuela

Venezuela is the second largest customer of the United States in Latin America and the second largest in the world in terms of per capita purchases. Such are the findings of a survey by Econometric Specialists, Inc. made for the Venezuelan Chamber of Commerce in the United States. Mexico is the largest buyer of U. S. goods in Latin America, and Canada makes the largest per capita purchases.

Results of the study were announced by Lloyd G. Smith, president of the Venezuelan Chamber of Commerce and vice president of Creole Petroleum Corp. Mr. Smith pointed out that 450 cities in 43 states manufacture goods which are shipped to Venezuela and 130,000 persons are employed in their production.

An important factor is that Venezuela is a "cash customer" because of its wealth in mineral production. Money to pay for U. S. products is earned by exports of petroleum and products, principally fuel oil to the east coast. Details of the study which highlight the necessity of trading with Venezuela are given in the 115-page report sponsored by the Chamber of Commerce and individual members such as Creole.

Oil Company Pilot Dies in Crash

Thomas Mayne Reid, famed Canadian pilot and aviation pioneer, and his wife died in the collision-crash of a TCA North Star airliner and an RCAF training plane over Moose Jaw, Sask., on April 8.

Ireland-born Pat Reid's flying career began in World War I, during which he won the Distinguished Flying Medal.

After the war he flew air routes in Europe and was manager for Handley-Page in Switzerland. He went to Canada, where he flew forest patrols for the Ontario Air Service and later carried on aerial exploration in the far north. In the winter of 1929-30 he led the relief expedition to the Siberian Arctic in the search for the noted flyer Carl Ben Eidelson. Mr. Reid joined Imperial Oil Ltd. in 1931 as western aviation manager and in the following year was made the company's aviation representative. Later he became aviation sales manager for Imperial Oil, Esso marketing affiliate in Canada.

In 1944 he was awarded the McKee trophy in recognition of 20 years of service to aviation including assistance to the research department of Imperial Oil in developing an aviation engine oil to meet conditions of extreme cold.

Mr. Reid was 59. He leaves a son, Flt. Lieut. John E. Reid, a jet pilot with the Royal Canadian Air Force.

Two New Bank Branches

The Royal Bank of Canada has opened two new branches to serve the banking needs of the rapidly developing Pembina oil region in Alberta. One is located at Evansburg and the other at Drayton Valley. For the time being, the Evansburg branch will be open on Monday, Wednesday and Saturday and the Drayton Valley branch on Tuesday and Thursday. Both branches are under the managership of W. H. Wood.

Opens Canadian Branch

G. Dikkers of Canada Ltd., affiliate of G. Dikkers & Co., N. V., of Hengelo, The Netherlands, manufacturers of oil valves, began operations in Canada on April 2, 1954. Headquarters and storage of finished products were established at 117 Crockford Blvd., Wexford, Ontario, in the Scarborough area of Toronto. General manager is T. O. van Dissel, formerly for many years district manager in the marketing section of Standard-Vacuum Oil Co. in the Far East.

Cuba Offers Support to Oil Development

The government of Cuba is ready to match capital funds with any foreign oil company willing to drill for oil in that country, according to a report given to the United States bureau of Foreign Commerce.

The offer was made in the name of President Batista by Dr. Amadeo Lopez Castro, minister without portfolio in the Cuban cabinet, and adviser to the president on economic matters. In this connection, Dr. Castro declared that the discovery of oil in commercial quantities would be the one outstanding development which could free Cuba from its present economic problems, caused by dependence on the sugar crop.

Dr. Castro stated further that his government would not expect to receive the oil that might be produced but would require reasonable royalties and a guaranty that the needs of the domestic market would have priority over export.

To Develop Peruvian Discovery

Douglas Oil Co. of California is preparing to develop a shallow zone that was discovered while drilling on the company's 122,000-acre Pacifico concession, lying along the northern coastline of Peru. The Douglas Pacifico No. 1 well logged and cored 110 feet of oil saturated sand between 1,910 and 2,100 feet. There is enough acreage for a 30 to 40-well program in the area, since Point Lobo, which could be used for drill sites, extends 1,800 feet out from the shoreline.

Meanwhile Pacifico No. 1 is drilling to explore deeper horizons. A second test, Douglas Lobitos No. 1, is drilling about a mile north, and a third about a mile and a quarter south.

Middle East Production

Crude oil production for the month of February 1954 is reported as follows.

	Feb. 1954	Jan.-Feb. 1954
	Long Tons	Long Tons
Iraq Petroleum Co., Ltd. (Kirkuk)	1,761,478	3,732,735
Basrah Petroleum Co., Ltd. (Zubair)	305,767	582,195
Mosul Petroleum Co. Ltd. (Ain Zalah & Butmah)	96,701	203,803
Qatar Petroleum Co. Ltd.	347,308	729,320
Kuwait Oil Co. Ltd. (830,000 b/d)	3,098,895	6,425,653
Aramco (940,000 b/d)	3,560,572	7,475,692

Kirkuk field production in January reported as 2,253,782 tons should have been 1,971,257 tons, which figure is incorporated in the revised total above.

New Venezuela Stores

Two new supply stores have been established in Venezuela by The Continental Supply Co. One is located in eastern Venezuela at Anaco, and one for the western territory on the east shore of Lake Maracaibo near the city of Las Morochas. Both stores will operate under the direction of H. E. Lowrey, manager of Venezuelan operations, whose offices are located in Caracas.

Manager of the Anaco store is J. B. Hutchings, with F. W. Dawson as sales representative. Store manager at Maracaibo is J. A. Buehrer, and sales representatives are J. B. McDonough and T. A. Mann.

Continental's office at Caracas, the capital and oil center of Venezuela, also directs the company's operations in Colombia, Ecuador and Peru. Other South American countries in which Continental has agents are Brazil, Argentina, Bolivia, Uruguay and Trinidad.

The Continental Supply Co., Inc., the company's export division with headquarters in New York, is headed by Julio Zumeta.

Canadian Gasoline to Japan

The first gasoline made from Canadian crude to be exported across the Pacific was scheduled to leave Imperial Oil's Ioco refinery near Vancouver, British Columbia in March bound for Japan. Projected export of the 4,550,000-gallon cargo by the tanker Stanvac Durban was announced several weeks ago.

The company hopes this shipment will be the beginning of an export market for Canadian petroleum products. Doubling of the capacity of the Ioco refinery, which now draws its crude from Alberta through the Trans Mountain oil pipe line, has made the movement possible.

Announce Canadian Oil Companies Ltd. Promotions

Canadian Oil Companies Ltd. has announced several promotions in top management to implement its expanding sales activity.

Douglas Robinson was appointed vice-president and member of the executive committee with special responsibilities in the accounting, finance, manufacturing and legal departments; and R. C. West, vice president formerly in charge of sales, became a member of the newly-created executive committee and will assist the president in guiding activities connected with the departments of marketing, supply and transportation, employee relations and purchasing.

A. Lawrence, formerly operations manager, becomes manager of marketing, a new position; and G. H. Tew, former manager of cost and economics, becomes manager of supply and transportation.

D. Robinson

R. C. West

A. Lawrence

G. H. Tew

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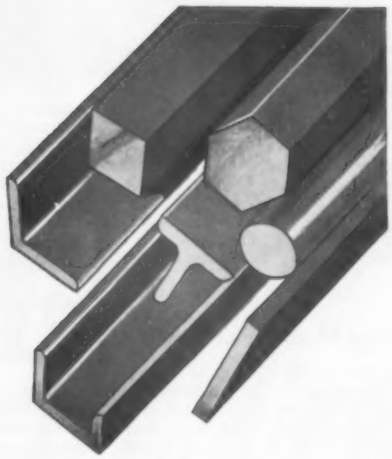

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Triad Profit Reported

Reports presented to shareholders of Triad Oil Co. Ltd. at the annual meeting, held March 16 in Calgary, disclosed the net income from production for the year ended November 30, 1953 to be $898,276, representing an increase of $100,354 over 1952 income. Triad's net oil reserves at November 30 were estimated at 12,794,755 barrels after producing 476,066 gross barrels of oil. Reserves at November 30 indicate an increase of 960,088 barrels over 1952.

E. H. Tanner, president, discussed the agreement with D'Arcy Exploration Co. Ltd., wholly-owned subsidiary of Anglo-Iranian Oil Co., Ltd., whereby that company will acquire $875,000 in 4½ percent convertible notes and 1,750,000 treasury shares for a total of $5,031,250. Under the terms of the arrangement, D'Arcy has the right to bring its interest in Triad up to not less than 50 percent by subscribing for additional notes and shares. This option is exercisable up to December 31, 1955.

Elected Honorary Member of AAPG

George S. Hume, chief of the Geological Survey of Canada, Toronto, has been elected to honorary membership in the American Association of Petroleum Geologists. As a symbol of distinguished service performed in the field of petroleum geology, a certificate of honorary membership was formally presented April 13, 1954 at the joint annual meeting of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists in St. Louis, Mo.

Caltex Crude Production

Crude oil production for March 1954 reported by Caltex for its Indonesian field was 926,991 barrels. Production of Bahrain Petroleum Co. for the same month was 932,933 barrels.

Director of American Chamber

Greer W. Oston, for 25 years a member of the Texaco organization in various executive capacities and since 1952 in charge of Caltex operations centering in the United Kingdom, has been elected a director of the American Chamber of Commerce, London.

New Gasoline Additive

McColl-Frontenac Oil Co. in Canada and The Texas Co. in the United States announced a new gasoline additive for premium motor fuel in April. It now is distributed across the continent.

The new additive is named Petrox. It is a compound derived entirely from petroleum by a catalytic process. Production is from a new plant at Port Arthur, Texas. Claims for the new product are that it reduces engine deposits and increases spark plug life by improving combustion characteristics. Rust prevention is stressed. Exhaust valve life is increased and engine wear decreased. Extensive road tests have been run.

Southern Production Enters Canada

Southern Production Co., Inc., of Fort Worth, and Canadian Atlantic Oil Co., Ltd., of Calgary, have reached an agreement whereby Southern will spend a minimum of $5 million in Western Canada before June 30, 1955 on exploratory work on certain undeveloped properties covering 4,000,000 gross acres in which Canadian Atlantic has an interest in the Peace River area in British Columbia and Alberta and in the Alberta foothills and plains areas. Annual extensions will be possible if additional sums are spent.

Joining in the agreement to the extent of their interests in these properties are Pacific Petroleums Ltd. and Peace River Natural Gas Co., Ltd., both of Calgary, and Sunray Oil Co. of Tulsa. The net acreage in which Southern can earn a half interest amounts to 3,500,000 net acres in 28 tracts.

Markets in British Columbia

Royalite Oil Co. Ltd. has begun marketing petroleum products in the interior of British Columbia following completion of distillation equipment at its new Kamloops refinery. Outlets are being established in the Okanagan Valley, West Kootenay and Cariboo areas and along the route of the Trans Canada Highway from Boston Bar, in the Fraser Canyon, east to Revelstoke. The company will support independent service station operators where good representation is available.

Bulk sales stations, agencies and distributors will be located at strategic points in each area. All products from the Kamloops refinery as well as a full line of automotive lubricating oils and greases will be marketed under the company's name brand.

Desk & Derrick To Meet in Canada

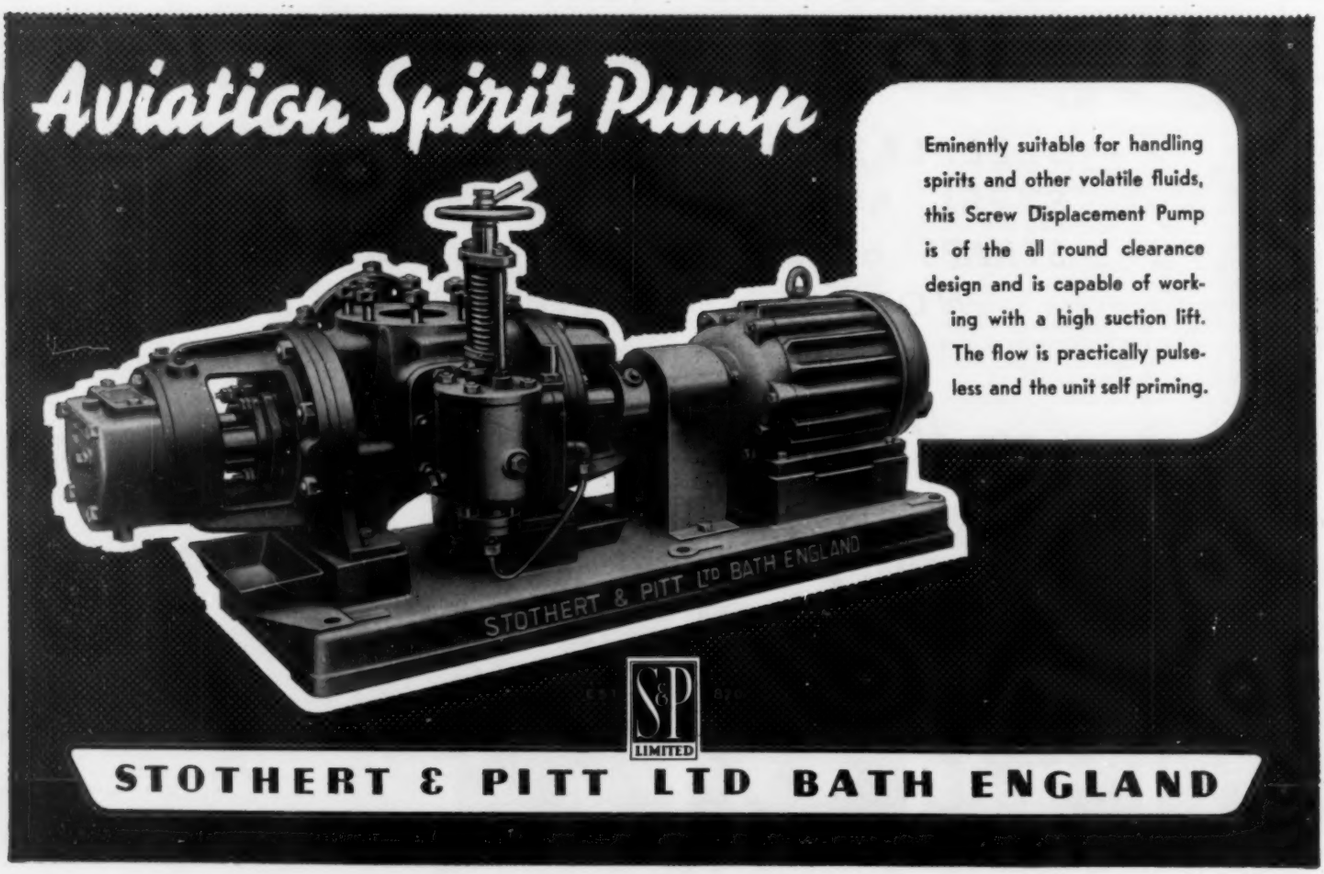
The third annual convention of the Association of Desk and Derrick Clubs of North America is to be held at Banff, Alberta, Canada, September 7 and 8.

The board of directors of the association met in Oklahoma City recently to approve convention plans as presented by Betty Heaton, the regional director for Region VII, which presently comprises the Canadian clubs. Edna Resky is convention general arrangement chairman. It is expected that more than 900 Desk and Derrick members will attend the convention.

Worthington Opens in Colombia

Worthington Corporation announces the recent establishment of a new subsidiary, Worthington Limitada, in Bogota, Colombia. Other Worthington Corporation Latin American subsidiaries are located in Mexico, Argentina and Brazil.

Worthington Limitada will be managed by Charles Gorham, who joined Worthington Corp. as an engineer in 1939.


Aviation Spirit Pump
Eminently suitable for handling spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.
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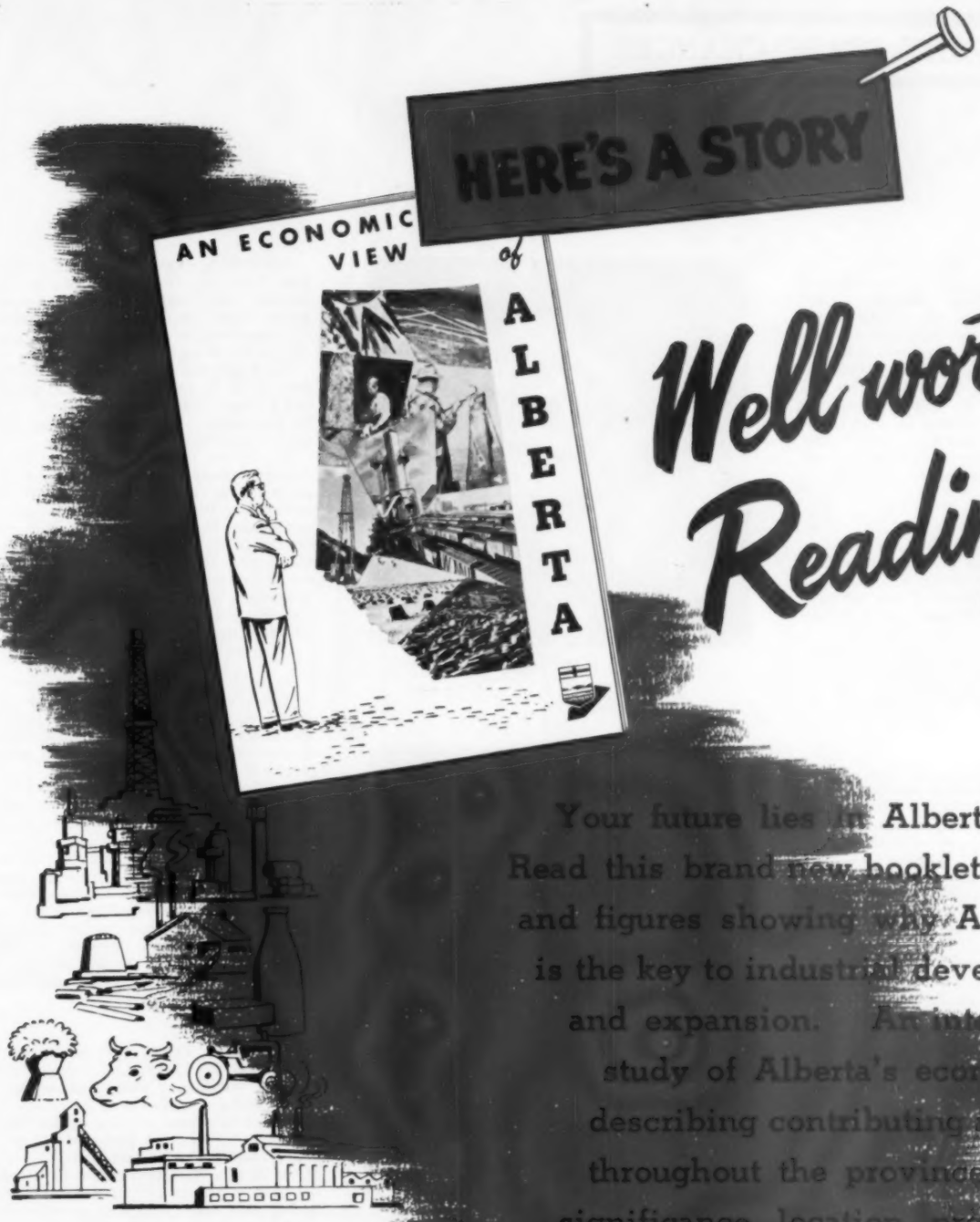
STOTHERT & PITT LTD BATH ENGLAND



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INDUSTRIAL DEVELOPMENT BOARD
DEPARTMENT OF ECONOMIC AFFAIRS

Hon. H. J. HOOKE,
Minister

Ralph R. Moore,
Deputy Minister

OIL COMPANY STAFF CHANGES

EDWARD E. EMRICK, JR., director of purchases, has been appointed exploration-production manager of the Ashland Oil & Refining Co. Mr. Emrick has headed the purchasing department for the past 12 years. During the same period he has handled other administrative and executive assignments including the management of several of the company's production districts. For the present, he will continue to direct purchasing policies. Frank L. Fisher continues as chief geologist. Nace F. Mefford, Jr., was promoted to chief production engineer. He was production engineer at the Henderson office before his transfer to Ashland.

T. N. LAW, JR., has returned to his duties as industrial relations manager of the Falcon Seaboard Distilling Co. He was stricken by polio last fall and spent several months in Warm Springs, Ga., but is now working full time again in the Tulsa main office of Falcon Seaboard. He is a fourth generation product of a pioneer oil family, with his great grandfather, T. N. Barnsdall, being credited with drilling the second oil well in Pennsylvania—only days after Col. Drake's famous discovery well.

V. R. TOMLINSON has been appointed counsel of Sinclair Refining Co., principal marketing and manufacturing subsidiary of Sinclair Oil Corp., to succeed the late Walter E. Brown, it has been announced by Joseph P. Walsh, general counsel of the parent company. Mr. Tomlinson, who has been general attorney of Sinclair Refining Co. since 1946, joined its legal department in 1926 in the Chicago office.

N. RULISON KNOX, former vice chairman of Bucyrus-Erie Co., has joined Husky Oil Co. as a director and a vice president in charge of the company's steel operations. Husky entered the steel warehousing and fabrication business by the purchase of Gate City Steel Works, Inc., of Omaha, Nebraska. Mr. Knox became president and a director of Gate City Steel effective April 1. He is establishing offices in Denver, Colo.

A. M. LANG has been appointed manager of the export sales department of General Petroleum Corp. to succeed N. H. Marsh, retired. Mr. Lang is a veteran of close to 30 years with General Petroleum. He joined the company and has been in export sales work since 1943.

D. PHILLIPS BAILEY has been promoted to industrial products sales manager for the eastern division of Tide Water Associated Oil Co. He has been assistant sales manager since 1952 and has been with Tide Water Associated since 1930.

IRVING E. CHAPMAN will replace Edward P. McCall as vice-president and director of Mitsubishi Oil Co. Ltd., Tokyo, Japan, it has been announced by Lloyd F. Bayer, vice president of Tide Water Associated Oil Co.

Tide Water Associated has a 50 percent interest in Mitsubishi Oil which owns and operates a petroleum refinery in Japan and is one of the principal distributors and marketers of petroleum products in that country. Mr. McCall is returning to the United States after having completed assignments in the Philippines and Japan since 1948. Mr. Chapman has been assistant manager of operations of the company's western sales division.

E. E. Emrick, Jr.

V. R. Tomlinson

I. E. Chapman

JOSEPH L. SEGER, president of Interstate Oil Pipe Line Co., Shreveport, La., has resigned to become vice president of The Carter Oil Co., Tulsa. The new appointment is effective June 1. Mr. Seger will be succeeded as Interstate head by George A. Wilson.

Mr. Seger was a member of Carter's legal staff from 1933 to 1946. He became general counsel and a director of Interstate in 1946. A year later he was elected vice president and in 1951 was elected president.

Mr. Wilson joined Standard Oil Co. of Louisiana—now Esso Standard Oil Co.—in the law department in 1941. During World War II he served with PAW as director of supply and transportation. In 1945 he was elected president of Interstate Natural Gas Co. of Monroe, La., and remained with the gas company until his resignation in December 1953. Since January 1, Mr. Wilson has lived in New York, where he has been a special assistant to the coordinator of transportation of Standard Oil Co. (N.J.).

W. A. M. GREEVEN has been elected a director of Creole Petroleum Corp. He fills a vacancy caused by the resignation of Dr. Cecil L. Burrill, who has returned to the Standard Oil Co. (N.J.) to become manager of the general economics department.

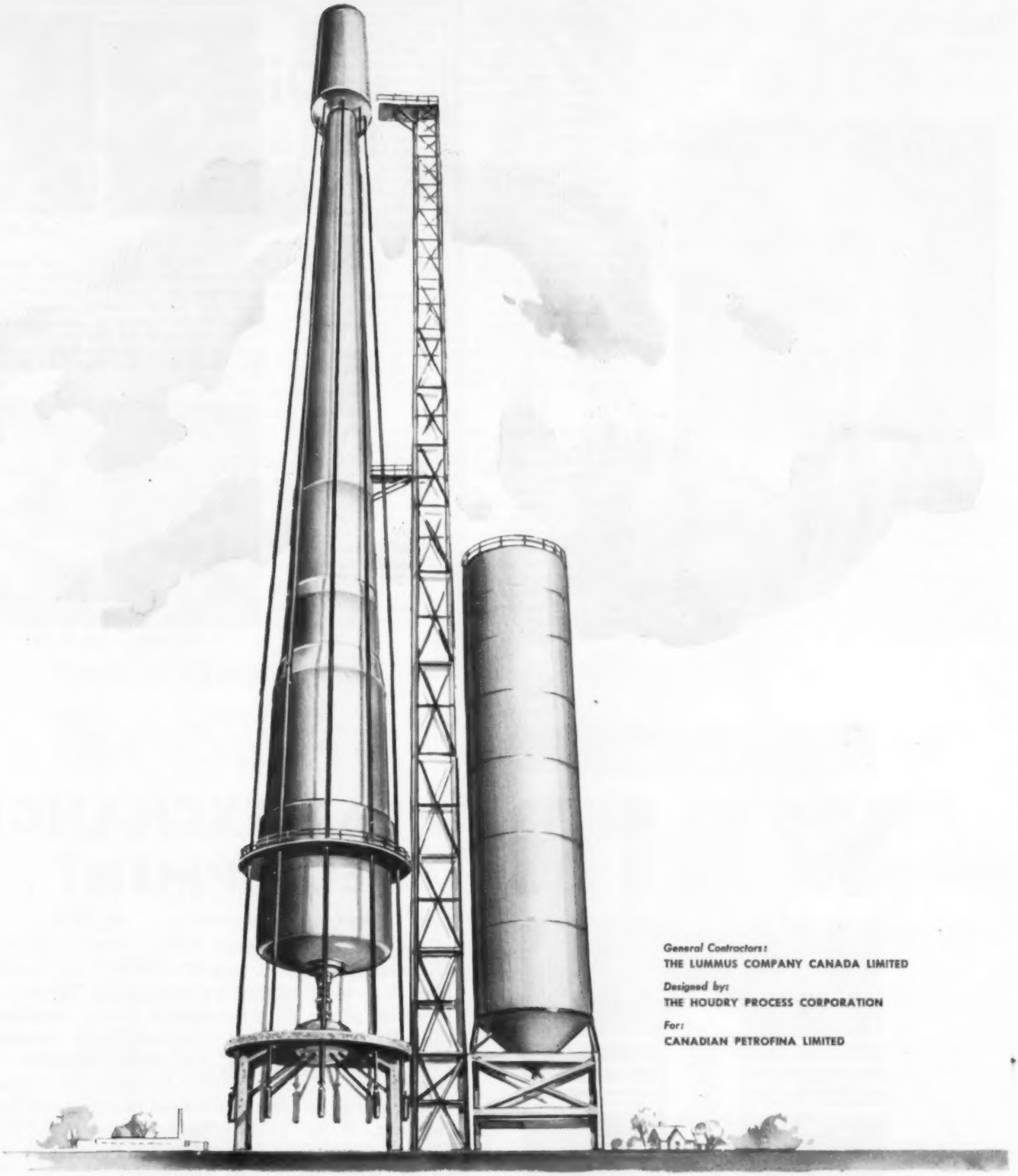
Mr. Greeven joined Standard as a clerk in the southern division, New York, in 1925. In December 1929 he was sent to Santiago, Chile, on a training assignment with one of Jersey's affiliates and spent the next 20 years in various foreign posts, including Chile, Argentina, England and Germany. He returned to New York in June 1949, when he was appointed deputy marketing adviser on Latin America. In September 1950 he was sent to Lisbon, Portugal, as shareholder's representative of the Jersey interests in North Africa, Spain, and Portugal, which position he has resigned to join Creole.

GEORGE M. LEES, chief geologist of the Anglo-Iranian Oil Co. Ltd., London, England, was awarded the Sidney Powers Memorial Medal of the American Association of Petroleum Geologists at the recent annual meeting of the American Association of Petroleum Geologists at St. Louis.

Dr. Lees' main interest is in the oil geology of the Middle East and of the British Isles. He has been in the employ of Anglo-Iranian Oil Co. during his entire geological career, and has been chief geologist since 1930. Dr. Lees has been very active in British scientific societies, and has been an active member of the American Association of Petroleum Geologists since 1931.

TOM GAINES has been appointed chief petroleum engineer of Texaco Exploration Co. He has been assistant division petroleum engineer in the Rocky Mountain division of The Texas Co. at Denver since September 16, 1950. His new headquarters will be in Calgary. Mr. Gaines joined Texaco in 1940 as a roustabout in South Texas. From November 1940 to November 1945 he served with the U. S. Marine Corps, from which he was separated with the rank of lieutenant colonel. He later worked in Texas in various engineering assignments until transferred to Denver in 1950.

JOHN PAVILUK, sales engineer with the export department of Tide Water Associated Oil Co., has been named sales representative for the company in Rio de Janiero. He will work with the company's Veedol distributors in Brazil, Chile, Peru and Uraguay.



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MONTREAL
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C. E. BRANDON has been promoted from field foreman to field superintendent by The British-American Oil Producing Co. He formerly was stationed at the Grass Creek field near Thermopolis, Wyo. His new area is the Denver-Julesburg Basin with offices in Sterling, Colorado.

B. I. Graves

B. I. GRAVES, petroleum consultant, New York, has been elected a director of the Peerless Casuality Co., Keene, New Hampshire. Mr. Graves recently retired as vice president of Tide Water Associated Oil Co.

CHARLES F. ELDER has been appointed staff petroleum engineer of The Texas Company at New York. He has been assistant to the division manager of the company's Oklahoma division at Tulsa since May 1, 1953.

WILLIAM P. GEE, assistant to the president, has been placed in charge of all petrochemical and synthetic rubber activities for The Texas Co. A. W. Baucum succeeds him as assistant to the president. He has been assistant to the vice president in charge of the producing department since 1950.

The Texas Co. anticipates that its petrochemical operations will expand in the future and Mr. Gee is being relieved of all other duties in order to devote full time to this responsibility.

Mr. Gee entered the oil business in 1919, and was first employed by The Texas Co. in 1927 as a research chemist in the Port Arthur, Texas, refinery. In January 1947 he was elected vice president of Texaco Development Corp. in charge of process licensing and still remains a director of this company. On March 1, 1951, he was appointed assistant to the president.

Mr. Baucum started work for Texaco in 1934. He was appointed assistant to the manager of the producing department at Houston in 1948 and was transferred to New York in 1950. He is also a vice president and director of the Texaco Exploration Co., a wholly-owned producing subsidiary operating in Western Canada.

H. F. SINCLAIR, founder of the Sinclair Oil Corp. and a director since the company's formation in 1916, is retiring from the board with the expiration of his present term of office on May 19, 1954. He retired as president of the company in 1949, being succeeded by P. C. Spencer. Mr. Sinclair continued, however, as a member of the board and its honorary chairman.

To fill the vacancy created by the retirement of Mr. Sinclair, the board has nominated Wm. Gage Brady, Jr., former chairman and president of The National City Bank of New York, and present chairman of the boards of American Enka Corp., textiles, and of Fundamental Investors, Inc., an investment trust.

W. P. Gee

A. W. Baucum

EDWARD H. SALRIN, vice president and director of Tide Water Associated Oil Co., retired April 30 after 40 years of service with the company and its predecessor companies. He has served as vice president and director of Tide Water Associated for the past 20 years. Since 1932 he has directed Tide Water's operations in the mid-continent area from joint offices in Tulsa and Houston.

H. F. Sinclair

W. G. Brady, Jr.

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Heat Exchangers for all duties. Crude-to-Residue Exchangers, Side Stream Exchangers, Oil Coolers, etc. Vapour Condensers for vacuum, topping or cracking plants. Final Condensers (water circulated) and Partial Condenser (circulated with incoming crude). Weir Refinery Equipment includes Oil Pumps for all duties, Steam Ejectors for Vacuum Stills, and all auxiliaries for Feed pumping and Feed heating. Write for Catalogue Section IL.8 "Weir Pumps for the Oil Industry" and Publication No. IL.38 "Weir Power Plant Auxiliaries."

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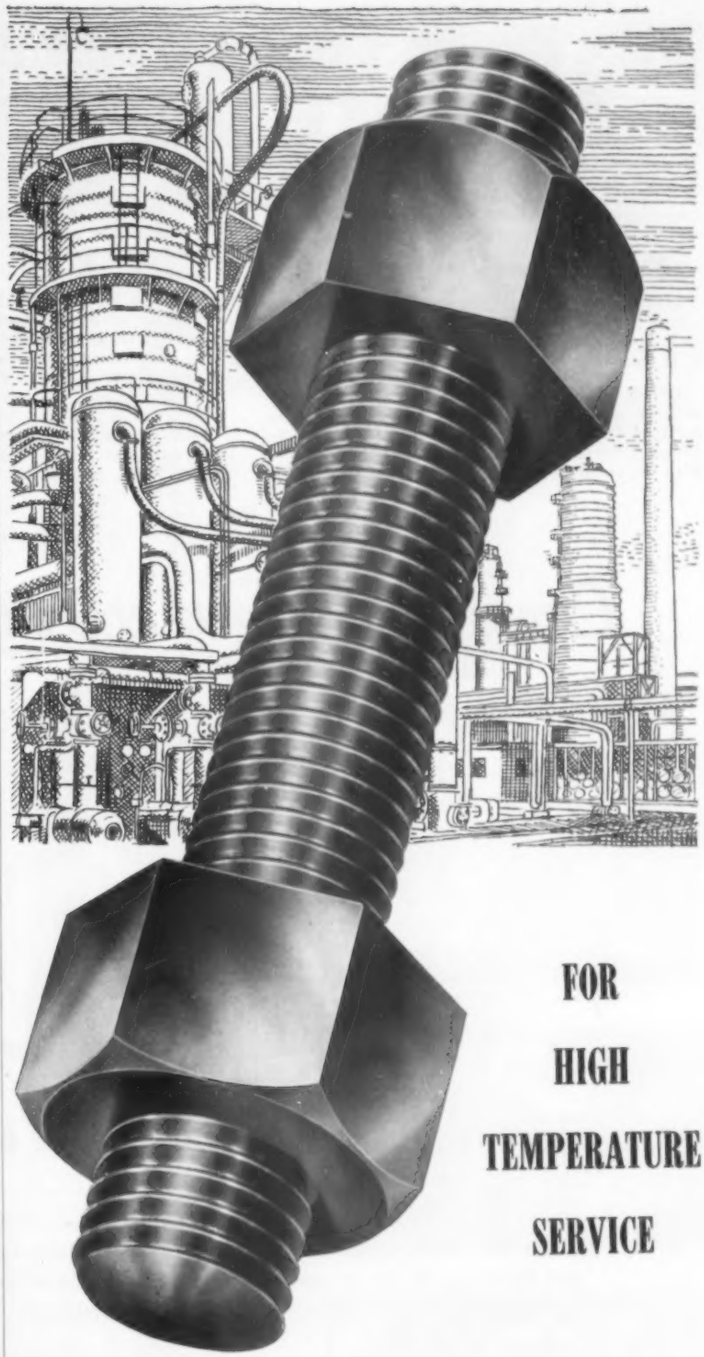
COMPRESSOR & POWER PLANT ENGINEERS FOR MARINE & GENERAL



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Conforming to B.S.S. 1750-1951, Stud Bolts and Nuts are being supplied by Rubery Owen to all the principal Oil Companies and Refinery Equipment Manufacturers in ever increasing quantities. Special production facilities have been planned to suit every requirement to both British and American Standards with either Unified or Whitworth Threads.

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HERBERT PARKER, former assistant chief geologist, has been promoted to chief geologist for Sun Oil Company's Gulf Coast division. He succeeds K. V. Schroeder, who formerly was both chief geologist and manager of the land department. Mr. Schroeder is still land department manager and now is acting as assistant manager of the division. Mr. Parker joined the geological department in 1947, after about 10 years in the seismograph department as a research computer and seismograph supervisor.

GORDON J. BUCKLE has been promoted to district superintendent of the southern district of The British-American Oil Producing Co., with offices in Houston. He formerly was district engineer in Oklahoma City and succeeds the late Errol J. Hesser.

HENRY COOPER, chief engineer in the eastern division marine department of Tide Water Associated Oil Co., has retired after having completed a total of 28 years of continuous service with the company.

DR. W. C. HOWELLS became general manager of the newly-formed domestic producing department of McColl-Frontenac Oil Company Ltd. Dr. Howells was formerly manager of Anglo-American Exploration Ltd. The formation of this new department will allow McColl-Frontenac to re-enter the exploitation field in Western Canada on its own behalf in addition to continuing its working agreement with Texaco Exploration Co. as heretofore, under which agreement McColl-Frontenac has conducted its producing activities during recent years.

JAMES N. GORRINGE has been named coordinator of management development by Esso Standard Oil Co. He succeeds Owen W. Humphrey, who has retired. He will head a program undertaken in 1945 to build a reserve of qualified people as replacement for key management positions and to assist management people to function more effectively in their present jobs. Mr. Gorringe was assistant process superintendent at the Bayonne, N. J., refinery.

Dr. W. C. Howells

WILFRID S. FENTON, New York industrial sales manager for Tide Water Associated Oil Co., has been transferred to the company's export sales department and named to the post of foreign sales representative for Europe, the Middle East and North Africa, it has been announced by E. F. McCabe, eastern division vice president in charge of sales. In his new position he will represent the company in the entire European area, as well as in Middle East and North Africa countries.

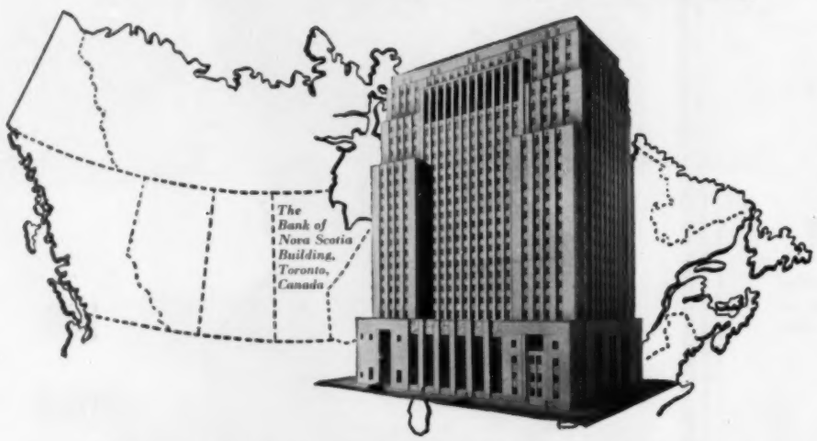
W. S. Fenton

J. B. SAUNDERS, JR., of Houston, president of Triangle Refineries, Inc., has been elected vice-president of Texas Eastern Transmission Corp.

Mr. Saunders has been active in the oil business since 1922. Since that time he has been a roustabout, a tool dresser, a refinery construction worker, and later a refinery office worker. He organized Triangle Refineries in 1937. It is the largest independent marketing organization for petroleum products in the United States.

J. B. Saunders, Jr.

Canada offers you opportunity



and here is the international bank to help you

THE soaring output of the Albertan fields is little more than an indication of Canada's oil potential. The development and financing of this potential offers one of the most exciting opportunities in the history of the petroleum industry.

The Bank of Nova Scotia, with more than 400 branches in Canada, Great Britain, the U.S.A. and the West Indies, and with correspondents wherever men trade, offers all the advantages of a truly International Bank to all who are interested in Canada's oil boom. It is equipped to give authoritative information and expert guidance on any of the many banking and financial problems confronting the oil man.

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IF ROPE COULD TALK . . .

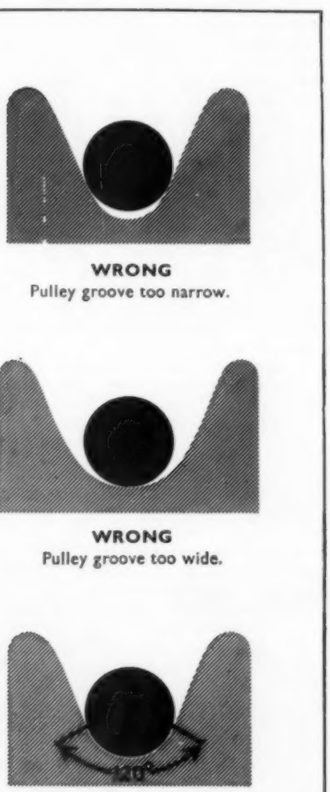
"Stop pinching me, you pulley!"

You can't punish ropes **and** expect to get the best out of them. So watch your PULLEYS and SHEAVES.

The radius of the groove of a pulley should always be slightly larger than that of the rope passing over it. If the groove is too narrow, it will crush the rope and soon damage the wires.

If too wide, the rope not only wears more quickly at the point of contact but also cuts a false groove in the pulley.

With sheaves, oil the bearings at frequent intervals and check that they rotate freely. A seized up sheave can ruin a rope very quickly. Watch alignment too; see that sheaves, drums and pulleys are set exactly in line with the rope that is working over them.



WRONG
Pulley groove too narrow.

WRONG
Pulley groove too wide.

RIGHT
Pulley groove correct—supporting the rope for 1/3rd. of its circumference.

Write for a copy of a new booklet "If Rope could Talk."

Pin up this announcement where your staff can see it. *It is issued in the interests of longer rope life by*

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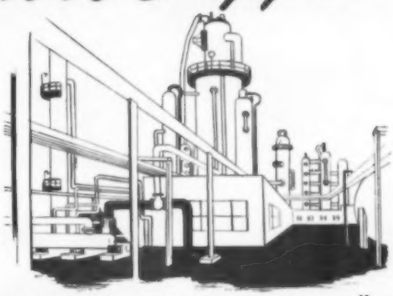
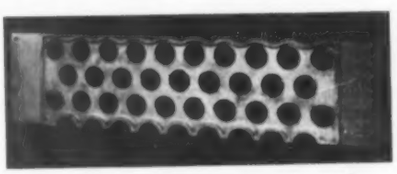
HEAT RESISTING

Tube Supports

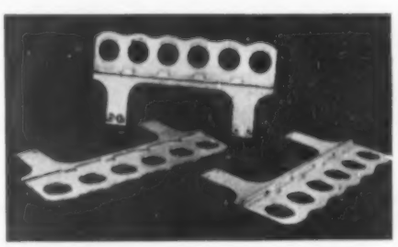


MADE FROM OSBORN "TROPIC" HEAT-RESISTING STEEL

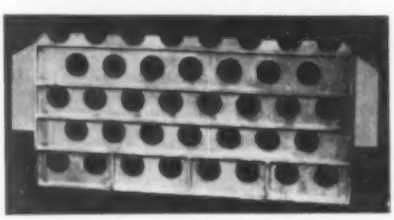
"TROPIC" Fireproof Steels have been developed primarily to provide an alloy with exceptional Heat-Resisting qualities eminently suitable for furnace parts.



"TROPIC" Tube Supports are cast from these Chrome Nickel Alloys, to meet A.S.T.M., B.S. and Oil Company Specifications.
They are guaranteed accurate to drawing dimensions and are imparted with a superfine finish. Long Service at High Temperatures is assured.



"TROPIC" Steels are available in Sheet, Plate and Bar Form, also Forgings for making up into ancillary equipment.
Samuel Osborn & Co., Limited are major producers of Heat-Resisting Steel Furnace Castings, for refineries throughout the world.



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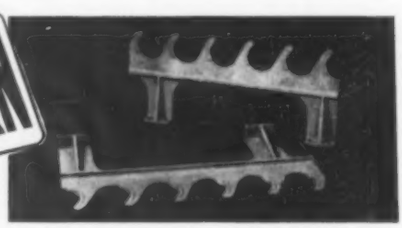

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A. E. ERNST has been elected a vice president of California Texas Oil Company following prior service as assistant to the chairman of the board. Mr. Ernst has been associated with Caltex, or affiliated companies, since 1936, and has served in various capacities in Africa, the Far East and Europe. During World War II he was in charge of petroleum for the Lend Lease Administration and for the Foreign Economic Administration in Washington.

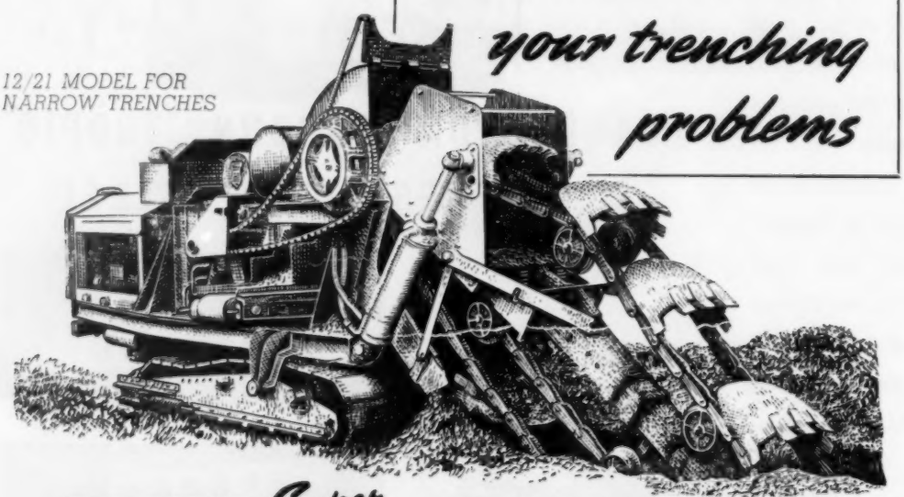
R. E. Lindt has been made an assistant vice president, fiscal division of Caltex. His connection with the company dates back to 1933 and has been mainly concerned with financial operations including service as cashier, assistant treasurer and assistant to the fiscal vice president. For the past five years he has been in charge of the company's financial planning department.

FRED POWELL has been appointed assistant general manager of Standard Oil Company of California's manufacturing department, with responsibility for co-ordinating chemical manufacturing activities. He previously headed the subsidiary California Research & Development Company, which has been dissolved following completion of its assignments for the Atomic Energy Commission.

A chemical engineering graduate of the University of Washington, Mr. Powell joined Standard of California in 1925 and has held a succession of increasingly important posts in the company's refineries or subsidiaries located in El Paso, Texas, and Perth Amboy, New Jersey. In 1948 he was made general manager of the El Segundo plant, which post he held until his appointment as president of CR&D in 1950.

The answer to all your trenching problems

12/21 MODEL FOR NARROW TRENCHES



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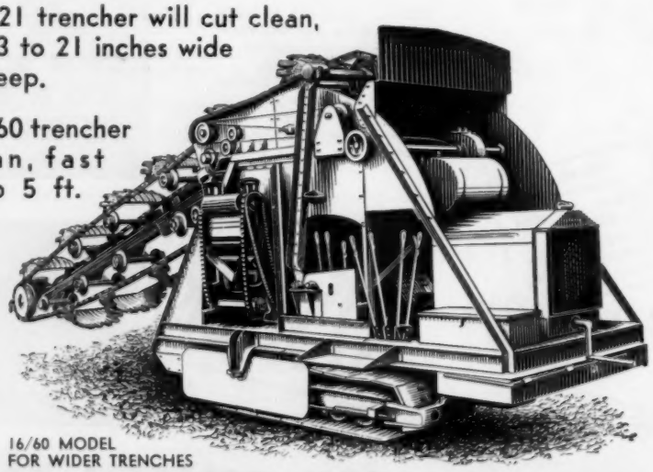
The Model 12-21 trencher will cut clean, fast trenches 13 to 21 inches wide down to 6 ft. deep.

The Model 16/60 trencher will cut clean, fast trenches up to 5 ft. wide down to 14 ft. deep.



Illustrated catalogues sent on request.

16/60 MODEL FOR WIDER TRENCHES

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M. L. Haider

L. P. Maier

MICHAEL L. HAIDER has been elected president of International Petroleum Co. Ltd., affiliate of Standard Oil Co. (N.J.). He succeeds L. P. Maier, who becomes chairman. Mr. Haider assumed his new duties April 1. He has been deputy coordinator of Jersey Standard's producing activities since March 1952. Mr. Maier has been president of International for the past nine years. Mr. Haider joined The Carter Oil Co. at Tulsa in 1929. He was promoted to chief engineer in 1936 and transferred to New York in 1938 as manager of production engineering and research for Standard Oil Development Co., central research affiliate of Jersey Standard, and in 1945 became executive assistant in Jersey's producing department. He went to Imperial Oil Ltd. in 1946, and it was during his tenure in Canada that Imperial discovered the Leduc field in Alberta, starting the tremendous oil development which is still continuing. At the time of his return to Jersey Standard in 1952, he was vice president and director of Imperial. As president of International, he will move to the company's office in Coral Gables, Fla.

Mr. Maier has been active in the petroleum industry since he served as a civil engineer with a Jersey affiliate in Mexico in 1920-21. Much of his service has been in South America, where he has been in executive posts with the Andean National Corp. Ltd. and the Tropical Oil Co. as well as International Petroleum. Mr. Maier was a captain in the U. S. Army Corps of Engineers during World War I, and a special civilian consultant to the U. S. Navy in World War II.

M. T. MCCANTS has been appointed plant manager for the new refinery to be constructed by the Great Northern Oil Co. at Pine Bend, Minn. The initial capacity of the refinery, which is now expected to be completed late in 1955, will be 20,000 barrels per day. Mr. McCants will be in charge of the construction and technical development of the plant. Mr. McCants has been with the Great Southern Chemical Corp., Corpus Christi, Texas, as general plant superintendent since 1951.

Previously he was a process and project engineer for the Fluor Corp. Ltd. His headquarters will be in the First National Bank Building, Saint Paul, until the new facilities for the company are completed at Pine Bend, which is located on the Mississippi about fourteen miles south of Saint Paul.

J. G. JIMENEZ, automotive product sales manager of the Middle Atlantic sales department of Tide Water Associated Oil Company, has been appointed assistant general sales manager for the eastern division. Previously assigned to Philadelphia, Mr. Jimenez in his new post will make his headquarters at the company's New York offices.

In 1930, he started with Tide Water Associated as a tank truck salesman and has advanced through positions as service station supervisor and district manager of various divisions in Eastern sales areas to his present appointment.

UOP of Louisiana Changes Name

The corporate name of Universal Oil Products Co. of Louisiana at Shreveport has been changed to Universal Polychem Co. All manufacturing operations conducted at Shreveport and Riverside, Ill., will be consolidated eventually into Universal Polychem.

Viscosity Measurement

Continuous Viscosity Measurement and Control of Viscosity

The Ferranti Portable Viscometer can be supplied in modified form to allow a continuous flow of liquid through the measuring annulus. An electrical signal proportional to the viscosity is provided which can operate standard recording and control gear. The instrument is particularly applicable to the measurement and control of non-Newtonian materials. (Write for list IN. 127).

Ferranti-Shirley Cone and Plate Viscometer.

The design features of this instrument include constant shear rate and shear stress throughout the fluid sample which may have a volume of less than 0·1 cm³ and a mean layer thickness of 0·001 in. The rate of shear is continuously variable over the range 0 — 25,000 sec^{-1}. A wide range of direct viscosity readings can be obtained. (Write for list IN. 126).

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***(Illustrated)* Portable Viscometer**

Special cylinders are now available to cover most industrial materials and conditions. (Write for list IN. 125).

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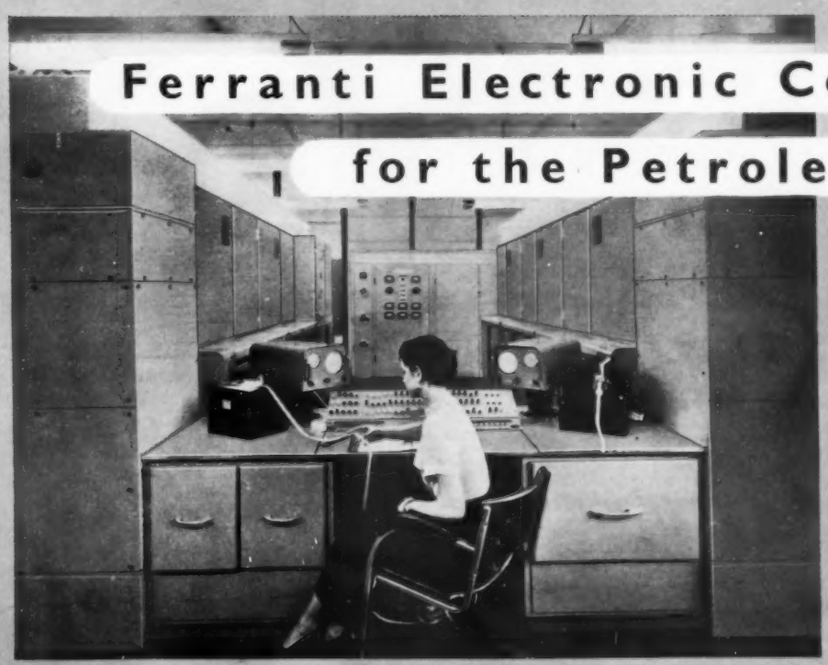
FI134

Ferranti Electronic Computers for the Petroleum Industry



Ferranti Ltd., are supplying an Electronic Digital Computer to Holland. The Computer has been purchased by the Shell Petroleum Company for installation in the Amsterdam laboratories of the Royal Dutch Shell Company and will be used for the rapid calculation of complex problems associated with the production of petroleum and its by-products. Ferranti computers are being applied to many problems in pure and applied science, mathematics, aircraft and general engineering design, commerce and statistics.

Manufactured under licence from The National Research Development Corporation

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DC9

President of Pike Drilling

Stanwood I. Williams, formerly executive vice president of Thomas P. Pike Drilling Co. of Los Angeles, has been elected president of the company, according to an announcement by the board of directors. The election fills the vacancy created by the resignation of Thomas P. Pike, recently named Assistant Secretary of Defense by President Eisenhower.

Howell G. Haney, vice president of the company in charge of operations, was named to the newly created post of chairman of the executive committee of the board.

Gene Graham, vice president of the organization, was elected executive vice president and was named to the board of directors where he will serve on the executive committee along with the new president and the chairman of the executive committee, H. G. Haney.

Mr. Williams has been a resident of Pasadena for the past 12 years. He is a native of California and a graduate of Stanford University where he took his degree in geology. He is one of the original directors and organizers of the Petroleum Club.

B & W Announce Research Appointments

The following appointments have been announced at the Research and Development Center of The Babcock & Wilcox Company by L. W. Wilcoxson, vice president: P. R. Grossman to be chief research engineer with responsibility for all work undertaken by the products, materials and technical sections of research and development; A. F. Boehm, manager of facilities, with responsibility for office management and maintenance; G. A. Watts to be superintendent of products section; J. F. Wachunas, superintendent of the technical services section; and W. O. Stone, Jr., purchasing agent of the Research Center.

McCarty Agency Establishes New Offices

As of May 1, the McCarty Company, advertising agency, is establishing offices in New York and Dallas by mergers with existing organizations. They will supplement the services of McCarty offices in Los Angeles, Chicago and San Francisco. This extensive expansion program is being undertaken to offer broader facilities to clients from coast to coast, according to Terrell T. McCarty, president.

In New York, negotiations have been completed under the supervision of Hiram E. Cassidy, executive vice president, for the merger of Laughlin-Wilson-Baxter & Persons, Inc., to operate hereafter as The McCarty Company Advertising, Inc.,

The predecessor company has operated in New York for many years. No change of New York personnel is contemplated. Howard Persons will continue to head the New York operations as president of eastern operations, assisted by Robert Holley, vice president. New offices are being opened at 430 Park Avenue.

In Dallas, the Russ Jurgens Advertising Agency has merged with The McCarty Company and will operate as the McCarty Company of Texas, Inc. Russ Jurgens will head the new operation as vice president and general manager.

Engineers Study Pressure Wells in Venezuela

Two engineers from the Dallas headquarters of Otis Pressure Control Co. are in Venezuela to confer with major operators on special installations of safety valves for high-pressure oil wells on Lake Maracaibo.

They are Lowell M. Wilhoit, vice-president in charge of sales and service, and Phil Sizer, design engineer. A study will be made to determine what special engineering may be necessary for the application of safety valves.

Well Surveys Expands

Aggressive plans for the expansion of Well Surveys, Inc., of Tulsa, Oklahoma, pioneers in research and development in the field of radioactivity well logging, are being made by Lane-Wells Co. with the purchase of the remaining 50 percent of Well Surveys, Inc. capital stock from Socony-Vacuum Oil Co. Lane-Wells has owned 50 percent of Well Surveys stock since December 1950, and since 1940 has been licensed to use methods and equipment developed by WSI.

Rodney S. Durkee, president of Lane-Wells Co., Lane-Wells Canadian Co. and Petro-Tech Service Co. of Venezuela, has been elected president of Well Surveys. Dr. John H. Buck, formerly associate director of a major project for Carbide & Chemicals Co., operators of Oak Ridge National Laboratory at Oak Ridge, Tennessee, for the past three years and previously supervisor of the physics division of the Socony-Vacuum research laboratories, has been named vice president and technical director, and will be in charge of operations in the Tulsa offices, laboratories and plants. D. W. Loots and Robert K. Schumacher have been named assistant treasurer and assistant secretary respectively and will be stationed in Tulsa.

Port Arthur Site Chosen for Koppers Polyethylene Plant

Selection of Port Arthur, Texas, as the site for the new plant of Koppers Company, Inc., to produce polyethylene plastic has been announced by George M. Walker, vice president and general manager of the company's chemical division.

Plans for this major expansion of Koppers chemical division into another plastic field were announced two months ago before the plant site had been definitely ascertained.

At Port Arthur, Koppers will purchase ethylene gas from new ethylene facilities being constructed at the nearby refinery of Gulf Oil Corp.

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Has unusually high creep strength for a pearlitic steel, good stability up to 1200° F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

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Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

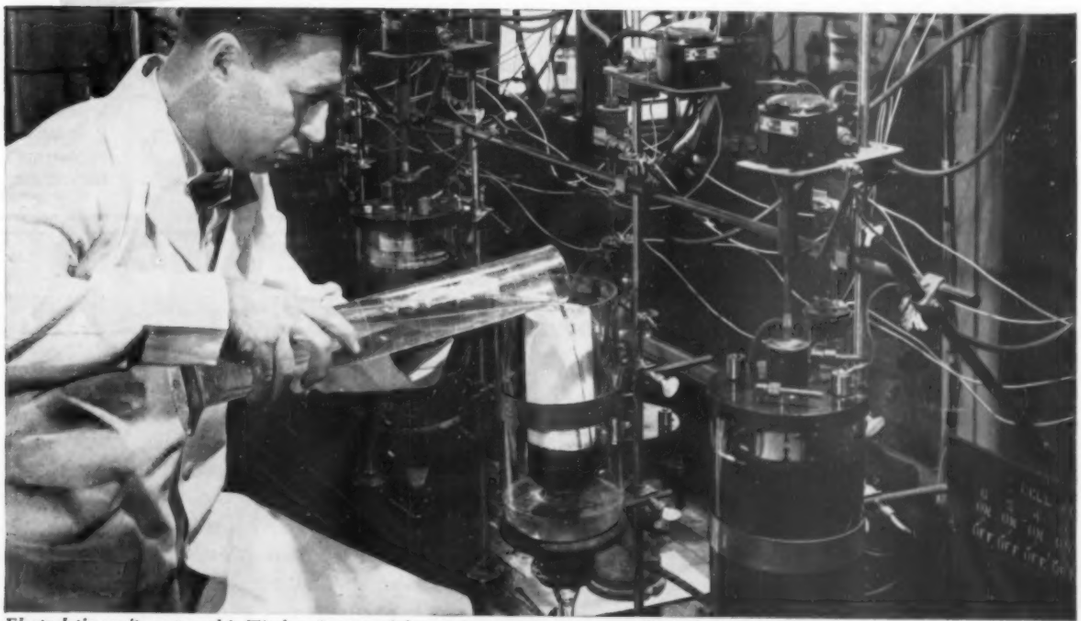
**Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

THERE are probably several high temperature tube steels that will solve your heat, pressure, corrosion and oxidation problems. But there's only one analysis that will give you maximum tube life per dollar.

To find it, *ask the experts!*

With over 20 years of steel research and experience, Timken Company metallurgists are recognized authorities on high temperature steels. They'll use this experience to help you select from 24 different analyses, pick the one tube steel that will give you the best life/cost ratio. And regardless which analysis you select, you'll be assured of uniform quality because the Timken Company rigidly controls quality from melt shop through final inspection.

Let the Timken Company's RSQ—Research, Supply, Quality—solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Electrolytic equipment used in Timken Company laboratories to extract non-metallic inclusions from steels in research on steel cleanliness

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Canadian Oil Consumption

(Continued from page 115)

penditures totaled $6 million and operating revenue 14 percent. The subsidiary Royalite Products Ltd. purchased a 5,000 b/d topping plant at Coleville, Sask., and began construction of a refinery at Kamloops, B. C.

McColl-Frontenac kept its dividend unchanged at $2.6 million in 1953 although net profit increased $1.4 million to $7.1 million. The company retained 63 percent of its net income in the business to finance its expansion program. Long term debt was reduced $1.2 million and capital expenditures totaled $7.6 million.

The group of five companies paid out $33 million in common stock dividends out of earnings of $113 million, retaining $70 million. The plowback of 62 percent of earnings is recognition of the burden on financing which Canada's rapid growth is making necessary.

In 1954 new records will be set by Canadian industry. First quarter reports reveal continued high demand. President Ole Berg, Jr., told his stockholders on April 1 that B-A sales were up 15 percent over the first quarter of 1953. A year ago Canadian Oil Companies Ltd. recorded a gain in sales of 28 percent. W. Harold Rea, president, now reports a new increase this year of more than 10 percent over last year's record.

Crude production in the first quarter was running 239,000 b/d, an increase of 72,000 b/d over the first quarter of 1953. More refinery capacity is coming on stream from month to month. Outlook for the industry is one of growth at a rate faster than that of the economy as a whole until Canadian oil is produced and refined in sufficient volume to meet domestic needs.

G.E. Announces New Hand Tachometer

A new portable, hand tachometer, featuring a scale-changing device which reduces misreading of its various ranges, has been announced by the General Electric Company's Meter and Instrument Department.

Canadian-US Group Plan Peruvian Drilling

Peruvian Oils & Minerals Ltd., a Canadian organization holding a large concession in the Oriente of Peru, has announced the conclusion of an agreement with Compania de Petroleo Ganso Azul, a subsidiary of Texas Gulf Producing Co., which is now engaged in oil production in that state, to undertake exploratory drilling on a part of the Canadian company's holding, the Santa Clara concession consisting of 30,000 acres. The agreement also provides for the division of oil and for its transportation and marketing by Ganso Azul in case commercial production is established.

Recording Controllers

A new line of process instruments including potentiometric and A-C bridge recorders and recording controllers has been announced by the General Electric Company's meter and instrument department. The instruments incorporate new measurement circuitry and components.

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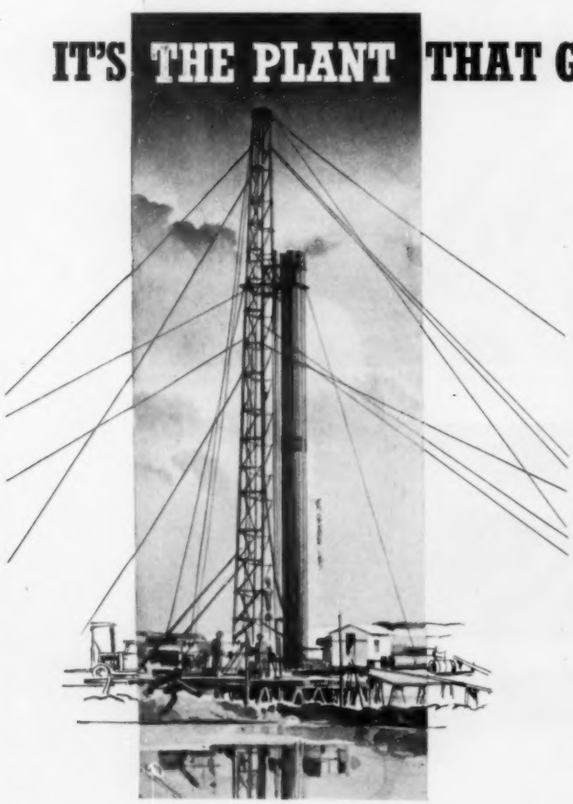

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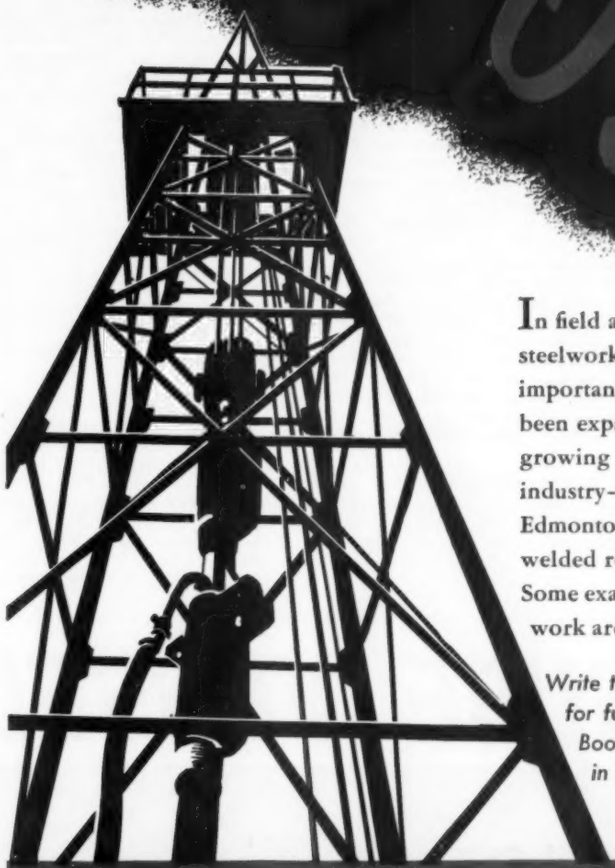

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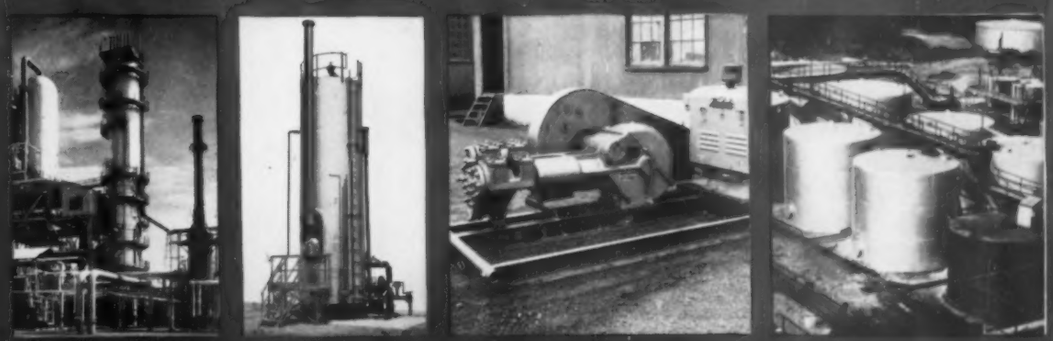

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MILLARD K. NEPTUNE, president of Platte Pipe Line Co., will resign from that company on July 1 to become president of Egyptian American Oil Co., with headquarters in Egypt. Egyptian American Oil Co. will operate a 75,000-square-mile petroleum concession recently granted to a group of American oil companies. Mr. Neptune will be succeeded as president of Platte by Ralph Moore, now vice president.

Prior to becoming president of Platte, Mr. Neptune had been with Phillips Petroleum Co. and Continental Oil Co. He began with Phillips as a laborer, and his last position with that company was as assistant manager in Venezuela. He left Phillips in 1948 to become manager of Continental Oil Company's foreign department. In June 1951 he became president of Platte. During World War II and the Korean War he served in the PAD as assistant director of production. Mr. Moore was with the Sinclair companies for 22 years before going with Platte when it was organized in 1950.

N. B. SAUVE, former chief geophysicist in Standard-Vacuum Oil Company's exploration department at New York, has been elected a director of Vacuum Oil Company, Pty., Ltd., Melbourne, Australia. He also has been appointed general manager of the Frome-Broken Hill Company, Pty., Ltd., an exploration company under Vacuum's technical management.

Recently reactivated with a substantial increase in capitalization, the Frome-Broken Hill Company originally was formed in 1946 by Vacuum, D'Arcy Exploration Company, Pty., Ltd., and the Consolidated Zinc Corporation, Pty., Ltd.

Mr. Sauve joined the Standard-Vacuum organization in 1934, following oil exploration experience in the United States and South America. He was in Sumatra when called to active military service as a colonel in the Army Reserves. He returned to Stanvac in 1945. His oil exploration activities in recent years have included assignments in Australia and Indonesia, as well as in the company's New York office.

M. K. Neptune

R. F. Moore

FRANK X. OWENS, former marketing assistant at the New York offices of Tide Water Associated Oil Company's sales department, has been named Middle Atlantic department accessories sales manager. In his new post, Mr. Owens will make his headquarters at the company's offices in Philadelphia.

Mr. Owens began his association with the company in 1930 as a clerk in the New York office. In 1936 he was made field inspector in the operating department, and the following year was transferred to the company's Bayonne, N. J., sales installation as foreman. He later held the posts of plant operator at several of the company's New England sales installations before being elevated to marketing assistant in 1952, the position he held until his recent advancement.

CHARLES D. VERTREES, Midland, Tex., division geologist for Continental Oil Co., has been promoted to the newly-created position of regional research geologist for the company's southwestern region. He will continue to make his headquarters at Midland.

HAROLD S. SKINNER, assistant general manager of Continental Oil Company's southwestern district, has been made administrative assistant to President L. F. McCollum. J. J. Dorgan, Jr. assistant to the president since 1952, will join Conoco's Rocky Mountain exploration department in Denver, Colo.

The changes announced by President McCollum follow the recent appointment of John G. McLean, professor of business administration at Harvard University, to the position of assistant to the president of Continental while on leave of absence from Harvard. During his association with Conoco, Mr. McLean will conduct special studies concerning the company's programs, policies and procedures.

Mr. Skinner joined Conoco's legal department at Ponca City, Okla., in 1948. He was promoted to general attorney for the company's central region at Oklahoma City in 1951 and the following year became assistant general manager of the central region.

Before joining Conoco, Mr. Skinner maintained a private law practice for 16 years at Holdenville, Okla. He received his bachelor's degree in 1929 from the University of Missouri and his law degree in 1932 from the University of Oklahoma.

Mr. Dorgan joined Conoco in 1948 at Ponca City and two years later transferred to the company's coordinating and planning department at Houston. He served one year in Washington with the Petroleum Administration for Defense and was named assistant to the president of Continental, with headquarters at Houston, in 1952.

JOHN R. MC MILLAN has been elected president of Fullerton Oil Company succeeding W. W. Valentine, who resigned following the sale by the Valentine group of their interest in the company.

Mr. McMillan was graduated in mechanical engineering from California Institute of Technology in 1931. He began his career with Barnsdall Oil Co. as a draftsman while attending college, and served 14 years with that company in the production and exploration departments.

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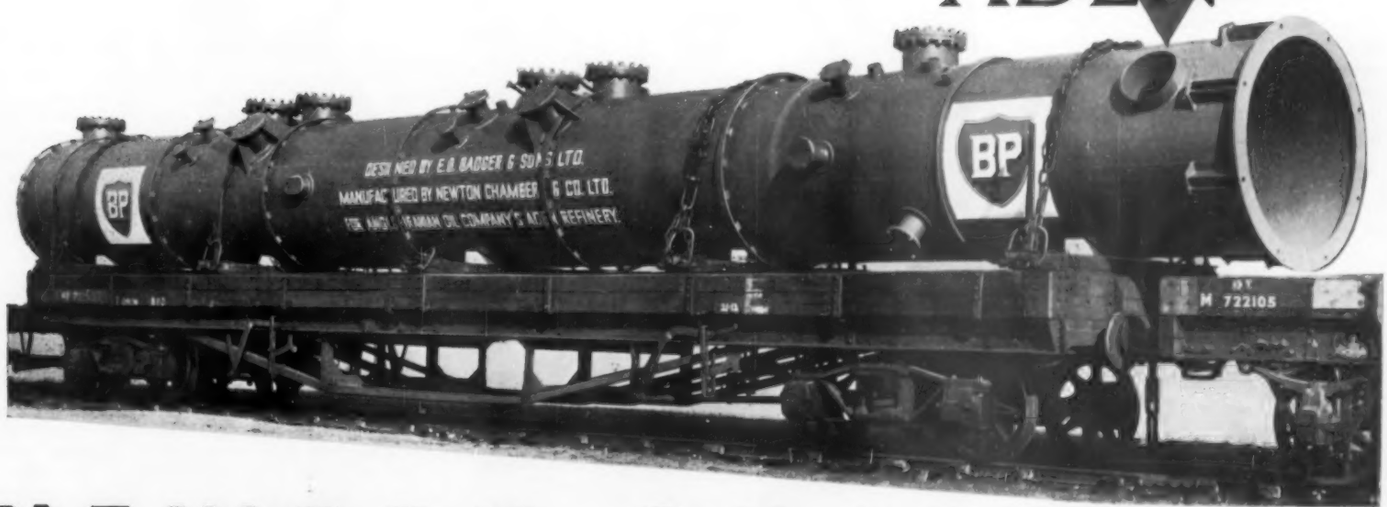
This is a Stripping Tower for one of the Aden Crude Topping Units and has been constructed to A.P.I. A.S.M.E. Code. It has a diameter of 5'6", its overall length is 62'2", and it weighs 17 tons. (Photograph by permission of Messrs. E. B. Badger & Sons Ltd., and Anglo-Iranian Oil Co., Ltd.)



NEWTON CHAMBERS

& CO. LTD, THORNCLIFFE Nr. SHEFFIELD

Magcobar Sales Appointment

K. L. Byerly, Jr., has been appointed assistant general sales manager for the Magnet Cove Barium Corporation of Houston.

Prior to his promotion, Mr. Byerly was manager of the company's Texas Gulf Coast division in Houston. A veteran of the U. S. Navy, Mr. Byerly has been with Magcobar since May 1948 and was formerly district manager for the company at Great Bend, Kansas, and Sulphur, Louisiana. He is a native of Beaumont and was formerly with the Cities Service Refining Corporation of Lake Charles, Louisiana.

Charles H. Sydow, Jr., has been named to replace Mr. Byerly as Texas Gulf Coast division manager. Since joining Magcobar in 1947 as a field service engineer, Mr. Sydow was a district manager in Shreveport, Louisiana, and most recently was division sales manager in the company's Gulf Coast division. A Navy veteran of World War II, Mr. Sydow was formerly with the Goodrich Synthetic Rubber Corporation.

Second Producer Completed at Nahorkatiya

Tests of the newly-completed No. 2 well at Nahorkatiya, Assam, the Lakhimpur village where sub-alluvial oil was found in Assam last year, show it to be a satisfactory producer, the Assam Oil Company has announced.

On initial testing, the new well, 10,520 feet deep, proved to be similar in caliber to the discovery well which is yielding an average of 500 barrels daily. Further tests will be needed to establish steady production and these will have to wait until the eight-inch crude oil pipe line from Nahorkatiya to the refinery at Digboi is complete.

The two wells thus far brought in are on the south bank of the Burhi Dihing river and produce from sandstone rocks lying deep under the alluvium of the Brahmaputra Valley. A third exploratory well has been started and a fourth will be begun later in the year. Locations for other wells have been chosen. Elsewhere in Assam geophysical surveys are proceeding.

Release Alaskan Geologic Map and Structure Sections

A geological survey map and cross sections of the Iniskin Peninsula and adjacent area of Alaska have been placed in open file, it has been announced by Secretary of the Interior Douglas McKay.

The material summarizes the present status of geologic mapping in this portion of southwestern Alaska, and is based largely on geologic investigations undertaken in the area during World War II and postwar years.

Oil and gas seeps have long been known on the Iniskin Peninsula and sporadic drilling was carried on between 1900 and 1938. A northeast-southwest trending belt through the central portion of the peninsula has, since early days, been the focal point of geologic interest. The present map, containing the results of detailed studies to date, shows the originally recognized anticlinal structure to be complicated by at least one strike fault of large displacement and a number of cross faults of smaller displacement.

The report, which was prepared by J. K. Hartsook of the Survey, is on file in the offices of the Geological Survey, Room 1933 (Library), General Services Administration Building, Washington, D. C.; Brooks Memorial Mines Building, University of Alaska, College, Alaska; Federal Building, Juneau, Alaska; and the Geological Survey Public Inquiries offices, 724 Appraiser Building, San Francisco, California, and 210 E. F. Glover Building, Anchorage, Alaska.

Drilling Program in Saskatchewan

Husky Oil & Refining Ltd. and Phillips Petroleum Company have started on a major exploration and development program for 1954 in the Kindersley area of western Saskatchewan, Canada.

They expect to drill approximately 20 wildcat and stepout wells, plus a number of development wells. The program began in late 1953 with the drilling of Glidden No. 1 and Marengo No. 1, both of which were completed as gas discoveries in the Viking sand.

In addition to the discovery of gas from a 24-foot zone in the Viking sand, Marengo No. 1 in Sec. 26-28-27 W3, located approximately 15 miles south of the Smiley-Dewar field, also found heavy oil production in the Detrital zone at a lower depth and is now waiting on pumping equipment for a production test.

French Discovery in New Area

Great interest has been aroused in French petroleum circles by completion of a discovery well which is held to presage the development of a new field. The well, designated as No. 1 Parentis, is located in the province of Gascogne, about 100 miles southwest of Bordeaux. It encountered a productive sand at a depth of 7,415-7,431 feet with an additional 100 feet of productive strata revealed by additional drilling to 7,531 feet.

On a primary test the well was reported as flowing at the rate of 1,100 barrels daily through a quarter-inch choke yielding oil of 33½ gravity containing a high percentag e of light products and with a low sulfur content. The well was drilled on a concession held by Societe Anonyme Francaise, a company in which the French affiliate of Standard Oil Co. (N. J.) holds a 63 percent interest and Gulf Oil Corporation 18 percent with the remainder held by French investors. The original bore is being carried to a greater depth and additional tests are planned for the area.

Husky Gets Production from the Ellenberger

Husky Oil Company has announced the recovery of 48 gravity oil at the rate of 50 barrels per hour on the first drill stem test of the Ellenberger formation on its No. 1 Cowden Ellenberger well in the Emma field, Andrews County, Texas. The drill stem test from 12,239 to 12,275 feet recovered 3,680 feet of 48 gravity oil on a two-hour test. The test showed no water. The company is drilling ahead on the well and will drill stem test again at 12,340 feet.

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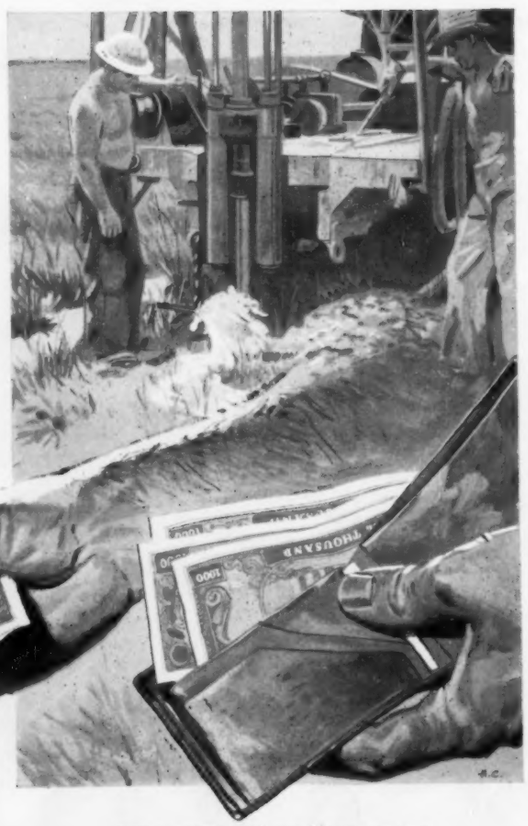
Since the introduction of Hawthorne "Blue Demon" Bits, major companies in West Texas have been able, with the same personnel and equipment, to increase party output more than 100% per month. This increased efficiency has tremendously reduced cost per profile, and has helped to finance new prospects in other areas.



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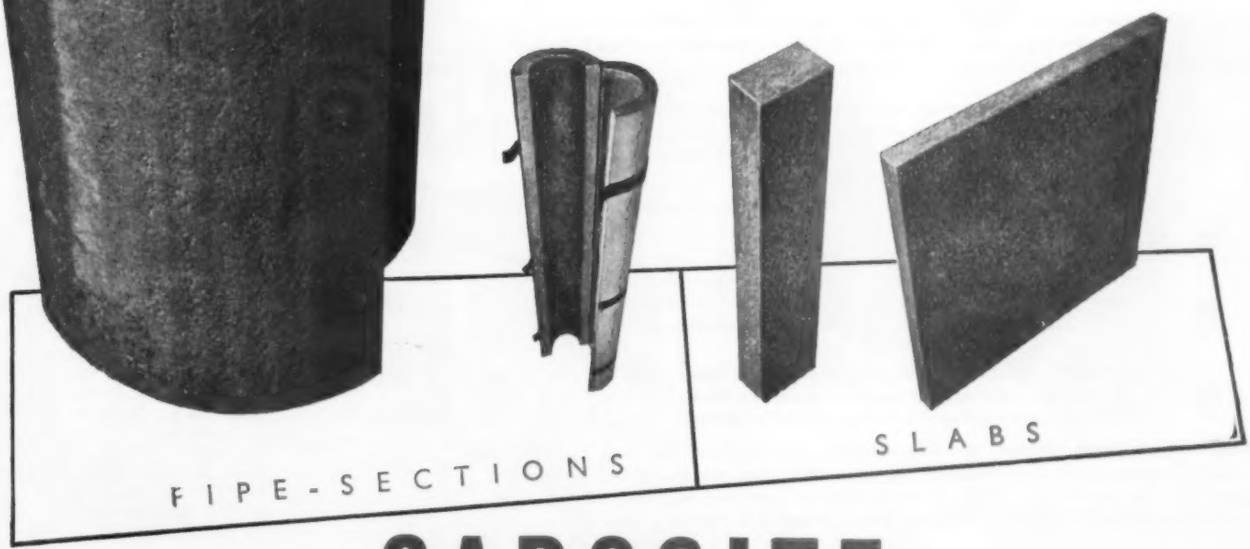

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Westinghouse Names Nunez Manager of Information Services

Luis G. Nunez has been named manager of the newly-created information services department of the Westinghouse Electric International Co.

Formerly manager of the sales promotion and advertising department, Mr. Nunez will now be in charge of the company's public relations, including publication of "El Ingeniero Westinghouse" and "O Engenheiro Westinghouse," Spanish and Portuguese language technical periodicals. He will also be responsible for translation services and providing price information throughout the company and its distributor organizations.

Mr. Nunez joined Westinghouse in 1919 at its Newark, N. J., plant, later serving in the International company as translator, salesman and regional supervisor. He was named manager of sales promotion and advertising in 1949.

Esso Safety Foundation Revived

Reactivation of the Esso Safety Foundation, after a lapse during the war years, to support and promote research and education in street and highway safety has been announced by Stanley C. Hope, president of Esso Standard Oil Co.

The Foundation, which was established in 1932, will provide grants to universities and state agencies working in the field of driver education, traffic engineering and enforcement.

In addition to lending active support and participation to other recognized public and citizens' groups in the field, the Foundation will coordinate all of the company's highway safety activities. Among the latter efforts will be the direction of a substantial portion of the company's newspaper, radio, television, and outdoor advertising space to stimulate safety consciousness and educational programs.

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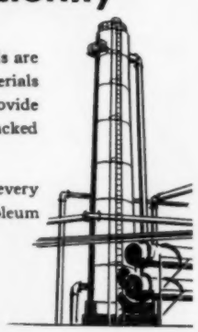
helps cleaning crews save time, cut costs, keep equipment operating efficiently

Specialized Oakite cleaning, descaling and related materials plus Oakite up-to-date methods are widely used in all branches of the petroleum processing industries. These specialized materials and methods . . . developed through more than 45 years of experience . . . are designed to provide you with the best in all round cleaning efficiency. What is more—all Oakite materials are backed by a binding guarantee. Your interests are fully protected.



Here are four maintenance jobs, typical of the type of many, Oakite is called upon to do every day of the year. These cleaning operations are fully covered in our free booklet "What Petroleum Men Should Know to Simplify Cleaning". Send for a copy.

1 **TOWER CLEANING.** Oakite lists a wide variety of compounds for removing waxes, resinous products, iron sulfides, oxides and other deposits from bubble caps, trays, downcomers. Circulation method eliminates costly manual cleaning.

2 **HEAT EXCHANGERS.** Oakite offers specialized alkaline and acidic type compounds for removing oil, carbon from shell side; lime scale, rust from tube side. Cleaning is done "in-place".

3 **PAINT STRIPPING.** You can strip paint from storage tank exteriors using your own equipment to apply, recover and recirculate stripper. Oakite provides a complete selection of alkaline and solvent strippers.

4 **SALVAGE.** Oakite has simplified methods to make salvage profitable. They give you a choice of specially compounded materials for cleaning and rust-proofing tools, fittings, valves, chains, pumps, etc.

ON-THE-SPOT SERVICE. Whenever you have a ticklish problem of cleaning to solve you can get quick on-the-spot advice by reaching for your phone and calling your local Oakite Technical Representative. His services are available at all times. For full particulars drop a line to Petroleum Service Division of Oakite Products of Canada, Ltd., 65 Front St. E., Toronto, Ont.

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P. H. Luckett

Heads Rockwell Instrument Sales

P. H. Luckett, a sales engineer with Rockwell Manufacturing Company's Macnick (instrument) division at Tulsa, Okla., has been named sales manager for the division. Mr. Luckett, who has specialized in Rockwell oil-field integrator and orific meter sales in the Houston, Texas district for the past two and a half years, will make his headquarters at Tulsa.

A-C Establishes New Sales Division

C. W. Schweers, vice president and director of sales of Allis-Chalmers' general machinery division, has announced the following appointments to his staff: O. V. Tally, director of industrial sales; J. S. Morgan, director of utility sales; and W. L. Manly, director of general purpose equipment sales.

Announcement was also made of the formation of a new northwest sales division under the management of M. M. York, formerly New England regional manager. This region will include the Chicago, Milwaukee, Minneapolis, Duluth, Davenport, Des Moines, Peoria, and Rockford offices with headquarters in Chicago.

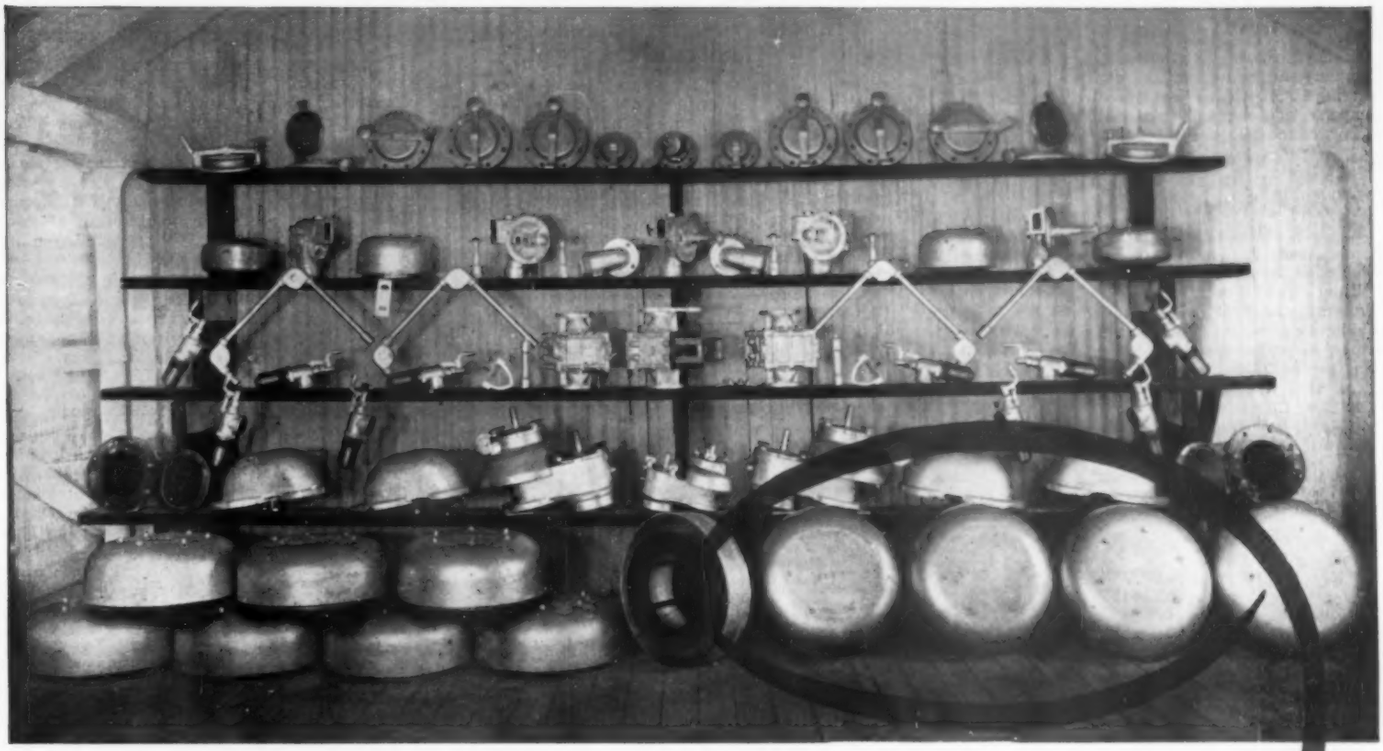
J. H. Burrus, Jr., formerly Milwaukee district manager, has been named manager of the Midwest region succeeding Mr. Tally, who held the post since 1950. This region now consists of the St. Louis, Indianapolis, Evansville, Louisville, Kansas City, Wichita, and Omaha offices, as well as the Memphis district. Headquarters are in St. Louis.

John E. Smet, formerly manager of the Hartford district office, was appointed manager of the New England region, succeeding Mr. York.

Iranian Negotiations in Progress

After several weeks of discussion at meetings in London, the representatives of eight international oil companies endeavoring to form a consortium to handle Iranian oil arrived at an agreement as to the terms they were willing to offer to the Iranian government and as to the participation of the several interests in the operations of the group. This division of interest is understood to govern the investment required from each member and also the proportionate quantities of oil to be accepted by each. According to report, the participation finally agreed upon assigned a 40 percent interest to Anglo-Iranian Oil Co., another 40 percent to the five American companies joining in the consortium, and the remaining 20 percent to the Royal Dutch/Shell and Compagnie Francaise with 14 percent going reportedly to the former and six percent to the latter.

Following this agreement, a committee of three representatives of the consortium with Orville Harden of Standard Oil Co. (N. J.) as chairman, H. E. Snow of Anglo-Iranian and J. H. Loudon of Royal Dutch/Shell, went to Teheran to begin negotiations with the National Oil Commission of Iran. These discussions are still under way at the time of writing with no report on their progress, beyond the statement of the chairman that he was "optimistic."



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Offer British made "VAREC" tank fittings manufactured to the designs of the Vapor Recovery Systems Co., of Compton, California. "VAREC" fittings are being supplied in large quantities for the Petroleum Industry for home and overseas use and the above photograph shows a number of such fittings recently supplied.

Fully descriptive catalogues are available upon request.

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The free vents shown opposite are designed for use on atmospheric vessels containing non-volatile products. Both types are equipped with mesh screens to prevent the entry of foreign matter. Standard of materials of construction are cast iron and/or aluminum.

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Fig. No. 26 & 27 series

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Seaboard Changes Name

R. S. McFarland, president of Seaboard Oil Company, announced at the annual stockholders meeting in New York that the official name of the company was changed from Seaboard Oil Co. of Delaware to Seaboard Oil Company.

Appointed Production Superintendent

John H. N. Evinger, formerly with A. N. Hendrickson, Midland, Texas, has been named production superintendent for Falcon-Seaboard Drilling Co. at Fort Morgan, Colo.

A graduate of Oklahoma University, Mr. Evinger has worked as a roustabout, as a driller's helper, in petroleum engineering, and as production superintendent with Landreth Production Corp., Gulf Oil Corp., Lyle Cashion Inc., and Deep Rock Oil Corp.

Engineering Director for Hammel-Dahl

John R. Curran has been appointed director of engineering by the Hammel-Dahl company, Providence, R. I., manufacturers of automatic control equipment.

A graduate of Northeastern University, Mr. Curran took extension courses at Massachusetts Institute of Technology in metallurgy and applied mathematics. He became associated with the Hammel-Dahl company in 1945 and during the past four years has been the company's chief design engineer.

New Davison Employee

Dr. Bernard Rudner has joined the research and development staff of The Davison Chemical Corp. at Hilltop Research Laboratories, Baltimore.

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Under to-day's conditions, the price of uncertainties, fumblings and second attempts is prohibitive at any stage, and nowhere more certainly so, than in plant erection. It requires a wide, practical experience of process engineering for the petroleum and petrochemical industries — like that possessed by D. & C. and William Press Ltd. — to ensure that operations keep abreast of to-day's development tempo.

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McKee Elects Two Directors

Two vice presidents of Arthur G. McKee & Co. have been elected to the board of directors, replacing two members who have retired from the company after long years of service as officers and directors.

Merrill Cox, a vice president in the metals division, and Myran J. Livingston, vice president in charge of the petroleum division, became board members at the annual meeting of stockholders. They replaced William A. Haven and J. Krumhansl.

Mr. Livingston joined the McKee company in 1944 as head of the New York office. Soon after coming to Cleveland, he became sales manager of the company's petroleum division in 1949, assistant to the president in 1952, and was elected vice president on April 21, 1953.

Mr. Livingston, who attended the University of Southern California, was responsible for the development of a number of important petroleum refining processes still widely used in the industry. He joined the M. W. Kellogg Company in 1930 and was active in that company's research and development division for a number of years.

Mr. Cox, a graduate of the University of California, spent four years with Illinois Steel Co. (now a part of the U. S. Steel Corp.) in Chicago before joining the McKee company in May 1930. He rose to the position of sales manager of the iron and steel division in 1949, general sales manager of the company's metals division in 1952, and was elected a vice president of this division on August 1, 1953.

To Manufacture Two-Zone Pumps

Otis Pressure Control, Inc., and the D&B division of Emsco Manufacturing Company, have concluded an exclusive agreement by which D&B is authorized to manufacture, sell and service the Otis Two-Zone pump. Announcement of the agreement is made by W. C. Kinder, Emsco's vice president and general manager of sales.

All engineering and manufacturing operations will be performed at the D&B plant in Garland, Texas. Installation, service and repair of the pump will be performed by trained D&B service men. This includes pumps in service and those to be installed.

Annin Expands Facilities

To provide additional facilities for the design and manufacture of automatic control valve equipment and for research and development of valves in the high pressure field, The Annin Company of Los Angeles has erected a new plant with more than 30,000 square feet of space. The enlargement was made to provide for expanded operation in the process industries as well as specialized activities in guided missile and atomic energy work.

Foster Wheeler Appointment

Charles C. Hornbostel has been appointed as administrative assistant to Earl W. Mills, president of Foster Wheeler Corp. Mr. Hornbostel was formerly president of National Company, Inc. of Malden, Mass. He was a Lieutenant Colonel, U. S. Army, Quartermaster Corps, 1941 to 1946. He is a graduate of Indiana University and of Harvard Graduate School of Business Administration.

Oliver Klinger

Oliver Klinger, founder and head of Oildom Publishing Company of Bayonne, New Jersey, died suddenly at the age of 70 from a heart attack at the home of his son Oliver Klinger, Jr. on April 23. He had been suffering from a heart ailment for several years, but remained active in the management of his business up to the time of his death. In addition to the magazine *Oildom*, Mr. Klinger established and directed several other journals including *Pipe Line News* and *The Pipe Liner*. He also founded the Pipe Liners Club and was its secretary and manager until his demise.

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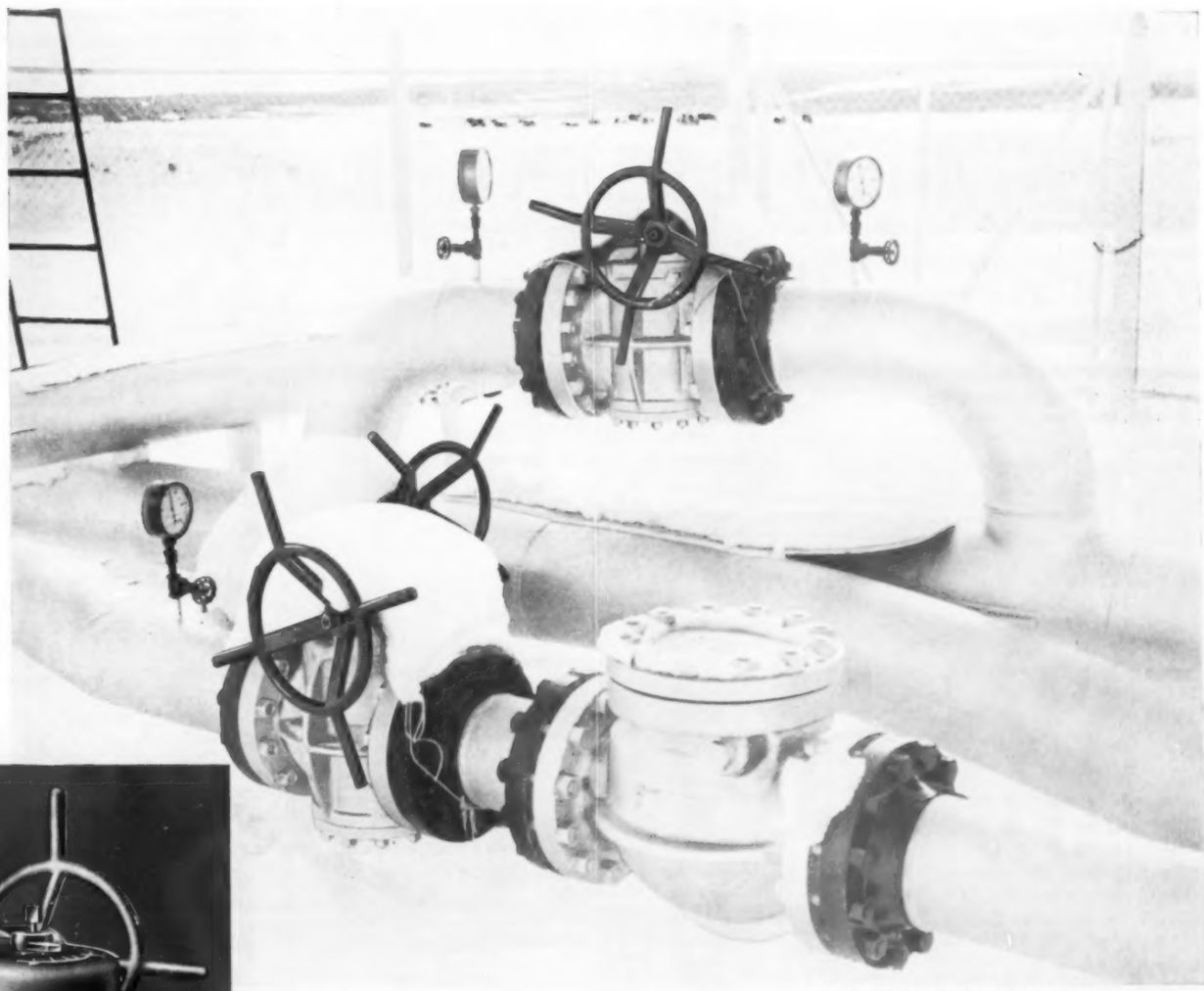

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ADVERTISERS' INDEX

(Advertising Agencies in Italics)

Aerofin Corporation 17
Richards & Webb, Inc.

Air Pumps Ltd. 69

John Allen (Oxford) Ltd. 210
Howard Bull Ltd.

A. E. Ames & Co. 142
MacLaren Advertising Co. Ltd.

Anderson International Contractors 50
James Lovick & Company Ltd.

Anglo-Iranian Oil Co. Ltd. 151
S. H. Benson Ltd.

Atlantic Refining Co. 75
N. W. Ayer & Son, Inc.

Atlas Asbestos Company Ltd. 13
Foster Advertising Ltd.

Audley Engineering Ltd. 12
Marsteller, Gebhardt & Reed, Inc.

Avery-Hardoll Ltd. 183
Crane Publicity Ltd.

E. B. Badger & Sons Ltd. 65
Thames Adv. Ltd.

Banff Oil Ltd. 161

Bank of Montreal 165
Doremus & Company

Bank of Nova Scotia 208
J. Walter Thompson Co. Ltd.

Barnes & Bell Ltd. 201

Bechtel Corporation 33
Ryder & Ingram Ltd.

Billington & Newton Ltd. 216

B.K.L. Alloys Ltd. 212
Sandbrook Metcalf & Co. Ltd.

Bolton's Superheater & Pipe Works Ltd. 187
Donald MacDonald (Adv.) Ltd.

British Ropes Ltd. 209
D. J. Keymer & Co. Ltd.

British Thomson-Houston Co. Ltd. 16
Technical & General Adv. Ltd.

Peter Brotherhood Ltd. 207
Rooster Publicity Ltd.

Burns Bros. & Denton Ltd. 161
Foster Advertising Ltd.

Burton Delingpole & Co. Ltd. 79
S. H. Wright & Co. Ltd.

The Butterley Co. Ltd. 57
Rowlinson Broughton

Calcana Oil Co. Ltd. 163

California Texas Oil Co., Inc. 58
Erwin, Wasey & Co., Inc.

Canadian Atlantic Oil Co. Ltd. 145
James Lovick & Co. Ltd.

The Canadian Bank of Commerce 145
Albert Frank-Guenther Law, Inc.

Canadian Oil Companies Ltd. 39
Crombie Advertising Co. Ltd.

Canadian Vickers Ltd. 205
MacLaren Advertising Co. Ltd.

The Cape Asbestos Co. Ltd. 219
Taylor Adv. Ltd.

Catalytic Construction Co. 136
Doremus-Eshleman Co.

Century Oils Ltd. 157

Chicago Bridge & Iron Co. 1
Russell T. Gray, Inc.

Cities Service Company 3
Albert Frank-Guenther Law, Inc.

City of Calgary 157
Stewart-Bowman-MacPherson Ltd.

Climax Rock Drill & Engr. Co. Ltd. 181
Technical Adv. Service Ltd.

The Continental Supply Co. 153-154
Ruthrauff & Ryan, Inc.

The Cooper-Bessemer Corp. 196-197
The Griswold-Eshleman Co.

Costain-John Brown Ltd. 41

Crane Company 60
The Buchen Company

Darling Valve & Manufacturing Co. 15
The Griswold-Eshleman Co.

Davey-Paxman & Co. Ltd. 174
Rooster Publicity Ltd.

Davison Chemical Corp. 24
St. Georges & Keyes, Inc.

Dikkers & Co. N. V. 29
Ir. J. Bauduin, Nederlands Reclame Adviesbureau

Dominion Bridge Co. Ltd. (Oil Industry Division) 215
McKim Advertising Ltd.

Dominion Engineering Co. Ltd. 78
Cockfield, Brown & Co. Ltd.

Dominion Securities Corp. Ltd. 146
Cockfield, Brown & Co. Ltd.

Draper Dobie & Company 214
Thornton Purkis Ltd.

Dresser Industries, Inc. 18-19
Don L. Baxter, Inc.

Dunlop Rubber Co. Ltd. (Dunlopillo) 225
Chas. F. Higham Ltd.

Dunlop Rubber Co. Ltd. (G.R.G. Overseas) 42
Chas. F. Higham Ltd.

E. I. du Pont de Nemours & Co. Inc. 67-68
Chas. L. Rumrill & Co. Inc.

E.C.D. Ltd. 189
Samson Clark & Co. Ltd.

Eisenwerk Streuber & Lohmann G.m.b.H. 183

Ernst Water Column & Gage Co. 214

Ethyl Corporation 7
Batten, Barton, Durstine & Osborn, Inc.

Federated Petroleums, Ltd. 143
James Lovick & Co. Ltd.

Ferranti Ltd. 211
Rowlinson Broughton

Flexible Drives (Gilmans) Ltd. 139
Boswell & Barratt Ltd.

Fluor Corporation 25
Dozier-Eastman & Co.

Foster Wheeler Corp. 27
Rickard & Co., Inc.

A. Gallenkamp Ltd. 181

General American Transportation Co. 10
Weiss & Geller, Inc.

G.E.C. Ltd. (General Electric Company of England Ltd.) 36
Kingscott Ltd.

General Electric, International 5
Grant Advertising, Inc.

General Geophysical Co. 31
Rives, Dyke & Co.

Geophysical Service, Inc. 77
Auld Advertising

E. A. Gibson & Co. Ltd. 225

Giffin Sheet Metals Limited 54

The Gourock Ropework Co. Ltd. 214
Sommerville & Milne Ltd.

Government of Alberta 203
Stewart-Bowman-MacPherson Ltd.

Graver Tank & Manufacturing Co., Inc. 76
The Buchen Company

A. P. Green Fire Brick Co. 53

Greenshields & Co., Inc. 161
Cockfield, Brown & Co. Ltd.

J. P. Hall & Sons Ltd. 181
Rooster Publicity Ltd.

Halliburton Oil Well Cementing Co. 86
Hill & Christopher, Inc.

Herb J. Hawthorne, Inc. 218
Brennan Advertising Agency

Home Oil Company Ltd. 143
J. J. Gibbons, Ltd.

Imperial Bank of Canada 226
McKim Advertising Ltd.

Independent Exploration Co. 74
Evans & Associates

Ingersoll-Rand Company 70-71
Rickard & Company, Inc.

International Harvester Export Co. 43
McCann-Erickson Corp.

International Paints Ltd. 47
Mayfair Adv. Ltd.

International Standard Electric Corp. 9
J. M. Mathes, Inc.

M. W. Kellogg Co. 37-38, 191-192
Gordon Baird Associates, Inc.

Richard Klinger Ltd. 171
S. H. Wright & Co. Ltd.

Lafarge Aluminous Cement Co. Ltd. 56
Allardyce Palmer Ltd.

Lake & Elliot Ltd. 177
Ripley Preston & Co. L'd.

Link, Downing & Cook Ltd. 143

London & Midland Steel Scaffolding Co. 62
S. H. Wright & Co. Ltd.

The Lummus Co. 84
Sterling Advertising Agency Inc.

McCullough Tool Co. 2
Richard P. Casterline Advertising

Arthur G. McKee & Co. 61
Meermans, Inc.

McLeod, Young, Weir & Co. Ltd. 139
Thornton Purkis

Magnet Cove Barium Corp. Cover III
Rives, Dyke & Co.

Makin Drilling Company 187

Mather & Platt Ltd. 8
Sidney F. Wicks Ltd.

Henry Meadows Ltd. 40
General Advertising Company of London Ltd.

Metal Containers Ltd. 172
Murray Watson Adv. Ltd.

Monarch Oils Ltd. 157

Moon Brothers Ltd. 52
Donald MacDonald (Adv.) Ltd.

National Airoil Burner Co., Inc. 161
R. E. Lovekin Corporation

National Petroleum Corporation Ltd. 163

Wm. Neill & Sons (St. Helens) Ltd. 221

Nesbitt, Thomson & Co. Ltd. 147
Crombie Advertising Co. Ltd.

Newman Hender & Co. Ltd. 223

Newton Chambers & Co. Ltd. 217
Stanley D. Dickson

C. O. Nickle Publications (Daily Oil Bulletin) 143

Nickle Map Service Ltd. 143

(Continued on page 226)

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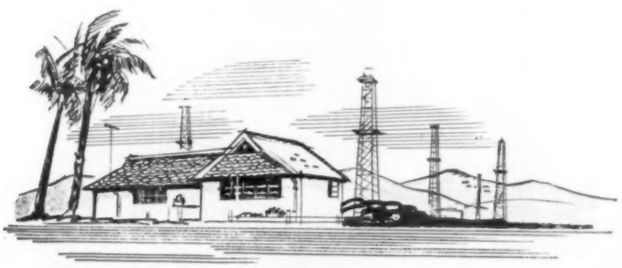

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Nordstrom Valve Div., Rockwell Mfg. Co. 12
Marsteller, Gebhardt & Reed, Inc.

Oakite Products of Canada Ltd. 220

Oil Center Tool Co. Cover IV
Rives, Dyke & Co.

Samuel Osborn & Co. Ltd. 209

Osler, Hammond & Nanton Ltd. 185
McConnell, Eastman & Co. Ltd.

Otis Pressure Control, Inc. 173
Dan Goodrich Advertising

Pacific Petroleums Ltd. 161
James Lovick & Co. Ltd.

The Ralph M. Parsons Co. 59
Dozier, Eastman & Co.

Petreco 73
John C. Fellows Co.

Petro-Chem Development Co., Inc. 21
Sam J. Gallay Advertising

Petty Geophysical Engineering Co. 81
Wallace Davis & Co.

Philco Corp. (Govt. & Industrial Division) 82-83
Julian G. Pollock Co.

W. C. Pitfield & Co. Ltd. 177
Thornton Purkis

D. & C. & Wm. Press Ltd. 222
Taylor Advertising Ltd.

Procon, Inc. 34-35
Simmonds & Simmonds, Inc.

Pye Telecommunications Ltd. 26
Arks Publicity Ltd.

The Pyrene Co. Ltd. 46
Nelson Adv. Ltd.

Reed Roller Bit Co. 66
Brennan Advertising Agency

Charles Richards Ltd. 183
H. C. Longley Ltd.

The Rice Hotel 144
Ritchie Advertising Agency

James Richardson & Sons 144
Thornton Purkis

The Royal Bank of Canada 141
Albert Frank-Guenther Law, Inc.

Royalite Oil Co. Ltd. 163
James Lovick & Co. Ltd.

Rubery Owen & Co. Ltd. 207
H. Raymond Morgan

Sandilands Valve Manufacturing Co. Ltd. 15
Griswold-Eshleman Co.

Sarnia Chamber of Commerce 199
Doremus-Eshleman Co.

Schlumberger Surenco 135
Rives, Dyke & Co.

Seismograph Service Ltd. 55
Watts, Payne Advertising, Inc.

Shell Oil Company of Canada Ltd. 28
J. Walter Thompson Co. Ltd.

Sidney Smith & Sons Ltd. 63
S. H. Wright & Co. Ltd.

Socony-Vacuum Oil Co., Inc. 72
Compton Advertising, Inc.

Southern Geophysical Co. 20
Cowan-Gilliam Advertising Agency

Southwestern Industrial Electronics Co. 48
Rives, Dyke & Co.

J. C. Sproule & Associates 145

Standard Oil Co. of California 44-45
Batten, Barton, Durstine & Osborn, Inc.

Standard Oil Co. of New Jersey 64
McCann-Erickson Corp.

Standard-Vacuum Oil Co. 51
Sam J. Gallay Advertising

Stewarts & Lloyds Ltd. 49
H. Raymond Morgan

Stothert & Pitt Ltd. 202

The Texas Co. 4
Cunningham & Walsh, Inc.

Tide Water Associated Oil Co. 11
Buchanan & Company, Inc.

Timken Roller Bearing Co. 213
Batten, Barton, Durstine & Osborn, Inc.

Toronto Iron Works Ltd. 167
The James Fisher Co. Ltd.

Universal Oil Products Co. 22-23
Simmonds & Simmonds, Inc.

Utility and Industrial Supply Co. (Canada) Ltd. 195

Henry Vogt Machine Co. 80
Farson, Huff & Northlich

Vokes Ltd. 32
Crane Publicity Ltd.

Warren Petroleum Corporation Cover II
Chapman Advertising Company

G. & J. Weir Ltd. 206
Scottish Industrial Adv.

White Motor Company 14
D'Arcy Advertising Company

Williams Brothers Corporation 163
Watts, Payne Advertising, Inc.

Wills, Bickle & Co. 145
McKim Advertising Ltd.

George Wimpey & Co. Ltd. 6

Wood Gundy & Co. Ltd. 140
Thornton Purkis Ltd.

Worthington Corporation 30
James Thomas Chirurg Co.

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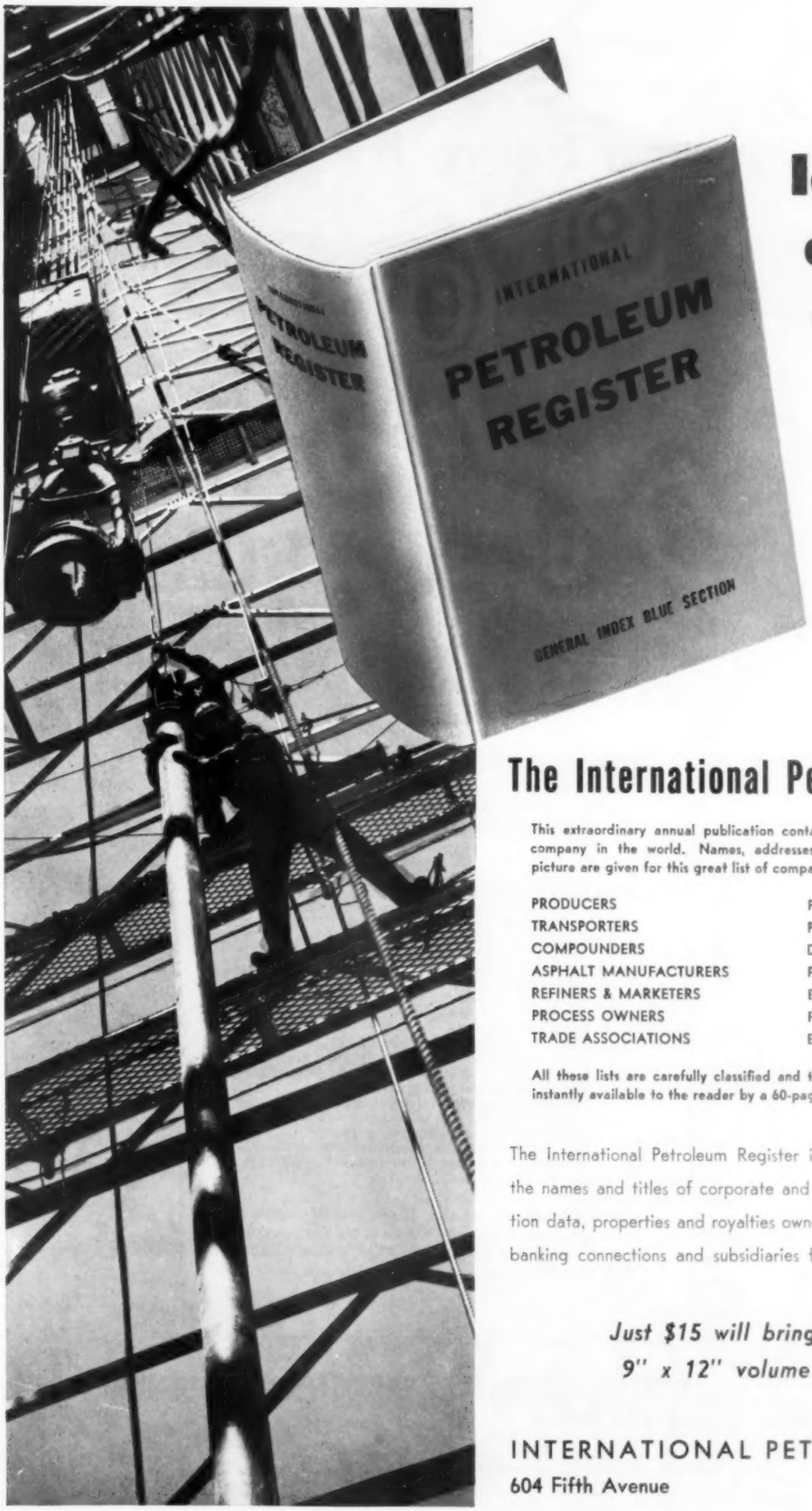

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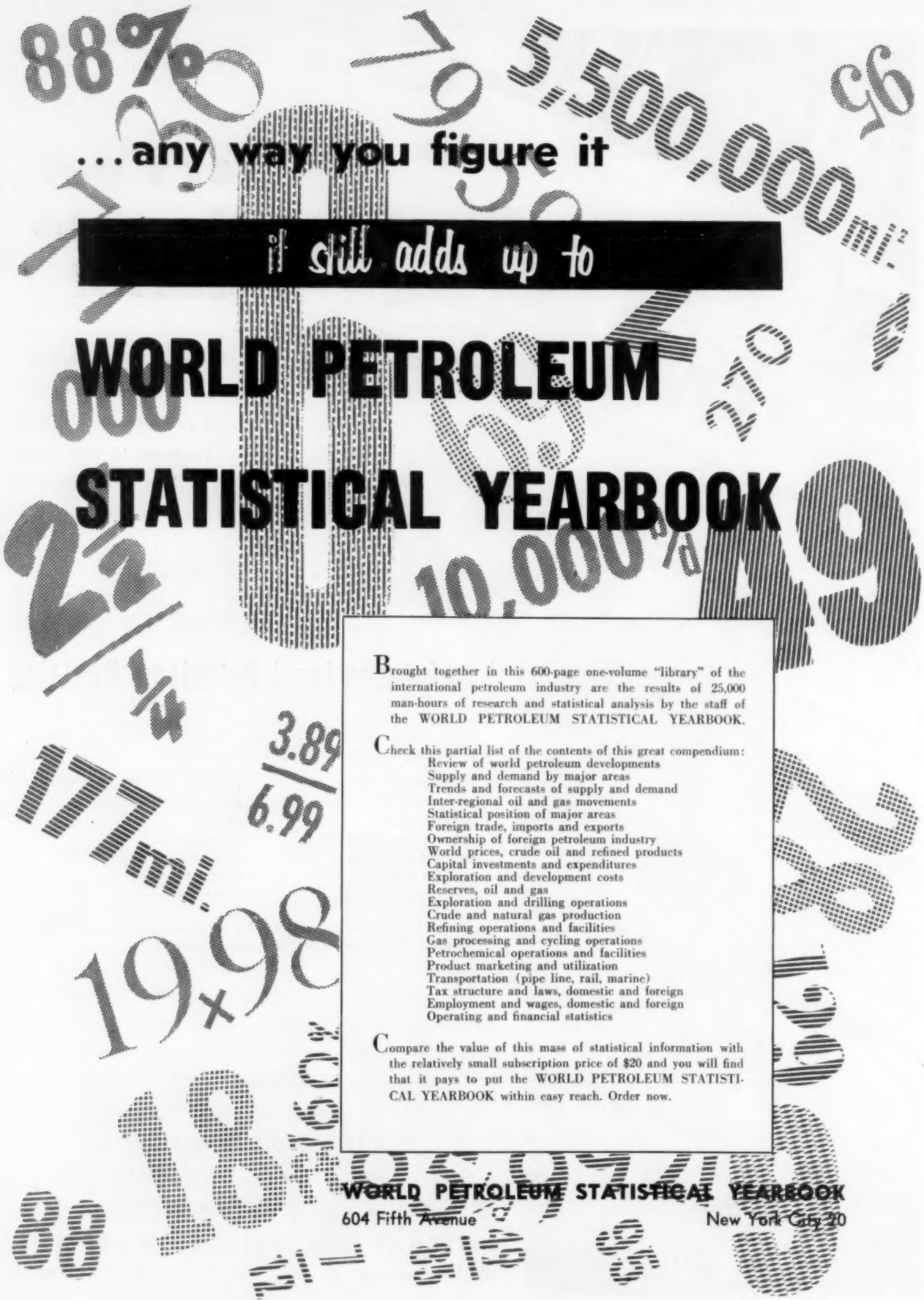

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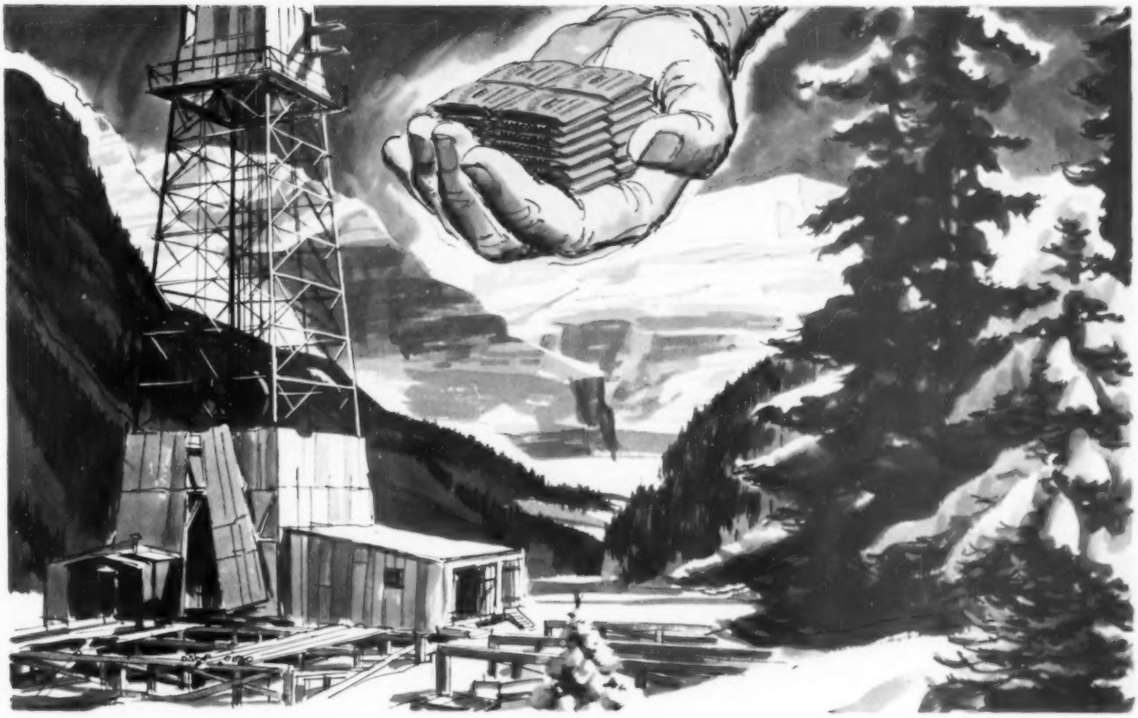

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